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LUTTRELL (E. S.). **Additional hosts of Diaporthe sojae.**—*Plant Dis. Reptr*, xxix, 3, pp. 89–90, 1945. [Mimeographed.]

During 1943 and 1944, in several localities in Georgia *Diaporthe sojae* was observed on soy-beans, groundnuts, snap beans, and Lima beans [*Phaseolus lunatus*], the two last being new hosts. There is little evidence that *D. sojae* is strongly pathogenic on any of these four crops. It was observed chiefly on senescent or weakened plants and was almost constantly associated with other fungi, notably *Macrophomina phaseoli*. A field of snap beans in which 40 per cent. of the plants were infected was still bearing, the chief infection being on dead pedicels, and at most *D. sojae* appears to be only a weak parasite.

MILLER (P. W.) & MCWHORTER (F. P.). **Studies on the control of Onion smut by seed treatments in Oregon.**—*Plant Dis. Reptr*, xxix, 3, pp. 93–94, 1945. [Mimeographed.]

In tests in the greenhouse of the dusts thiosan, arasan, fermate, and ceresan applied to onion seed for the control of smut (*Urocystis cepulae*), some significantly reduced infection of the seedlings but none was consistently as effective as the standard treatment with formaldehyde solution (1 in 100 by volume). In a field trial not only did none of the dusts give satisfactory control, but the sticking agent tended to clog the seeder and give uneven stands. The formaldehyde was less efficacious in the field (34·2 per cent. smutted seedlings).

DILLON WESTON (W. A. R.). **Leaf spot of Celery.**—*J. Minist. Agric.*, li, 12, pp. 561–563, 9 figs., 1945.

This is a brief, popular account of celery leaf spot (*Septoria apii* and *S. apii-graveolentis*) [*R.A.M.*, xxii, p. 236; xxiii, p. 285] illustrated by a chart. In England, *S. apii-graveolentis* is the more common and injurious of the two fungi.

HANSEN (H. N.) & TOMPKINS (C. M.). **The name of Ansatospora macrospora.**—*Phytopathology*, xxxv, 3, pp. 218–220, 1945.

In connexion with the application to the celery storage rot fungus by Newhall of the name *Ansatospora macrospora* [*R.A.M.*, xxiii, p. 324], it is pointed out that Hartig described the identical organism in 1880 (*Untersuch. forst.-bot. Inst. München*, i, pp. 58–61) as *Cercospora acerina*, the agent of a maple [*Acer*] seedling disease. The name was subsequently changed by Frank (*Krankheiten der Pflanzen*, Vol. ii, 1896) to *Sporidesmium acerina*, and by Arnaud to *Cercosporella acerina* (*Bull. Soc. Path. vég. Fr.*, v, pp. 58–60, 1918). Like Osterwalder, who found the same pathogen attacking pansy and named it *Cercospora macrospora* [*R.A.M.*, iv, p. 288], Hartig failed to recognize the nature of the conidial appendages, which are clearly shown in the illustrations of both authors. On the basis of priority, therefore, the fungus should in future be known as *Ansatospora acerina* (Hart.) nov. comb., its synonyms being *C. acerina* Hart., *S. acerina* (Hart.) Frank, *Cercosporella acerina* (Hart.) Arnaud, *Cercospora macrospora* Osterw., *C. cari* Westerd. & Van Luijk, and *A. macrospora* (Osterw.) Newh.

THOMAS (C. A.). **Studies on the Fusarium-wilt disease of Sweet Potato (Ipomoea batatas Poir).**—*Proc. La Acad. Sci.*, vii, pp. 23–24, 1942. [Received April, 1945.]

No loss in virulence was observed in 12-year-old cultures of *Fusarium batatatis* [*F. bulbigenum* var. *batatas*] and *F. hyperoxysporum* [*F. oxysporum* f. 2], the agents of sweet potato wilt in Louisiana, where the former species is the more prevalent and pathogenic. *F. bulbigenum* var. *batatas* imparted a powdery aspect to potato cylinders, and when the stroma covering the medium shrivelled, many small, blue blisters of sclerotial plectenchymata appeared. On the same substratum *F. oxysporum* f. 2 first produced an abundance of white mycelium and on desiccation assumed a gelatinous aspect. *F. bulbigenum* var. *batatas* gave rise to powdery, orange colonies on rice, followed at an advanced stage by dark blue to purple blisters, while the growth of *F. oxysporum* f. 2 was dark red, turning blue later.

BAWDEN (F. C.). **Plant viruses and virus diseases.**—*Nature, Lond.*, clv, 3928, pp. 156–158, 1945.

In this paper (based on two lectures at the Royal Institution on 21st and 28th November, 1944) the author discusses the meaning of the term 'virus disease', the effects of such diseases on plants, the manner in which infection takes place, and the application of the technique of protein chemistry to the purification of certain viruses. [Reprinted in *Trop. Agriculture, Trin.*, xxii, 5, pp. 89–92, 1945.]

HILDEBRAND (E. M.). **The Dodder vector of woody plant viruses.**—*Plant Dis. Reptr*, xxix, 7, pp. 196–197, 1945. [Mimeographed.]

In preliminary experiments towards the end of 1940, the writer succeeded in the transmission of the cucumber mosaic virus from its own host to cucumber, but not from cucumber to peach, with the aid of four species of dodder [*R.A.M.*, xxiv, p. 136], of which *Cuscuta subinclusa* and *C. campestris* were uniformly effective, while *C. californica* and *C. repens* gave positive results in some of the tests and failed in others. Attempts in the spring of 1941 to convey a number of peach viruses from their own host to tomato by means of *C. campestris* were successful only with X-disease and rosette viruses, but the results of tests on the re-transmission to peach were negative or inconclusive. All experiments in the transmission of the same viruses from peach to peach failed. In 1943 the studies on dodder transmission were handed over to G. W. Cochran, who repeated and confirmed the writer's observations on the passage of rosette from peach to tomato and those of Kunkel on the conveyance of the same virus from peach to periwinkle (*Vinca rosea*). It is important that the limitations of dodder as an agent of transmission from woody to herbaceous plants should be recognized.

WATERSTON (J. M.). **Plant diseases and pests.**—*Rep. Dep. Agric. Bermuda, 1944*, p. 7, 1945.

The disease of the Bermuda cedar [*Juniperus bermudiana*] described by the Plant Pathologist in his report for 1943 [*R.A.M.*, xxiv, p. 51] spread during the year. At least three pests have now been suggested as possible causes of the trouble. Pending entomological investigation, the trees have been thinned and cleared of underbrush and vegetation to give more air and strengthen them against attack.

Phytophthora parasitica damaged the Easter lily (*Lilium longiflorum*) crop considerably during the autumn rains. Bud rot, provisionally attributed to *Phytomonas cannae*, was recorded for the first time on flowering stems and root stocks of *Canna* causing minor damage. *Sclerotinia sclerotiorum* badly rotted flowering stems of roselle (*Hibiscus sabdariffa*); young citrus trees were treated for manganese and zinc deficiency with nutritional sprays. Melanose caused by *Diaporthe citri* was found severely damaging grapefruit in dense shade, and wither tip of lime caused by *Gloeosporium limetticola* was also recorded.

Box (H. E.). **Insect transmission of the 'swollen-shoot' virus in West African Cacao.**—*Nature, Lond.*, clv, 3942, pp. 608–609, 1945.

In studies at Tafo, Gold Coast Colony, on the insect transmission of cacao swollen shoot [*R.A.M.*, xxiv, p. 11], successful results were obtained with strain I of the virus, using the mealy bugs *Ferrisiana virgata* and *Pseudococcus exitiabilis*, with strain II using *P. exitiabilis*, and with strains III and IV separately, using *P. citri*.

Strain I, a virulent strain, is characterized in the plant by pronounced swellings in the recent ligneous growth, a typical foliage mosaic particularly noticeable in the newest leaves appearing after infection, and by death of the tree within eighteen months in the case of plants infected when less than two years old. Strain II, non-virulent, produces swellings only, or at most an indeterminate chlorosis, not always present, in the foliage. Strain III, non-virulent, produces mottling only, the pattern being distinct from that of strain I. Strain IV, non-virulent, produces a mosaic of the feather type, quite distinct from that produced by strains I and III.

It appears that more than one distinct virus may be concerned. The first recognizable symptoms appeared five weeks after the transfer of insects from affected plants. It was found that strain I could be transmitted by a single individual female of *P. exitiabilis*, and by this insect in its crawler stages. In one case, transmission occurred through females of the species, which had lived on the infected source plant for not over 48 hours. To ensure transmission, however, a minimum of ten females, preferably with accompanying larvae, is advised.

Thren (R.). **Gedanken zum Wirkstoffproblem in der Mikrobiologie.** [Reflections on the growth substance problem in microbiology.]—*Kühn-Arch.*, lx, pp. 253–264, 1 fig., 1 graph, 1944.

Reference is made to some recent studies on the vitamin requirements of fungi, and the writer's experiments on the development of haplont cultures of *Ustilago avenae* on a synthetic medium with and without aneurin [vitamin B_1] are tabulated and discussed. Although the smut was capable of growth, even at a very low rate of seeding (100 cells per 10 c.c.), in the absence of the accessory factor, its development was much more abundant when vitamin B_1 was added to the medium. Thus the mycelial weights of the four haplonts of a tetrad at the high seeding rate of 20,000 sporidia per 20 c.c. ranged from 6·1 to 13·7 mg. without vitamin B_1 and from 15·4 to 28·2 mg. with it, the corresponding figures for the low rate being from 3·7 to 9·2 and from 9·1 to 18·8 mg., respectively.

In a previous paper (*Arch. Mikrobiol.*, xii, p. 192, 1941) the author described at length the results of his experiments on the vitamin B_1 requirements of barley loose smut (*U. nuda*) in the dicaryophase, which presented a number of parallels with those of N. Fries on *Daedalea unicolor* [*R.A.M.*, xviii, p. 335], including the temporary cessation of growth, followed by a renewed impetus in the presence of the accessory substance at a dosage of 0·1 γ per 20 c.c. These and other anomalies are tentatively ascribed to divergences in the vitamin B_1 demands of the two haplonts in the combination, one of which is assumed to be heterotrophic and the other autotrophic in this respect.

It was ascertained that the inequalities in the vitamin B_1 content of the three barley varieties, Morgenrot (highly susceptible to loose smut), Heils Franken (moderately susceptible), and Nepal (very resistant), are too slight to account for the differences in their reaction to the disease.

Lasser (E.). **Das Sortenproblem im alpinen Pflanzenbau.** [The variety problem in Alpine plant organization.]—*Kühn-Arch.*, lx, pp. 358–368, 1944.

Alpine climatic conditions are highly conducive to fungal diseases in most cereal crops, causing losses of up to 100 per cent. The two most destructive are snow

mould (*Fusarium*) [*Calonectria graminicola*] and black rust [*Puccinia graminis*]. Rye ordinarily enjoys the reputation of comparative freedom from fungal diseases, but this observation does not apply in Styria. The Tauern winter variety is highly resistant to *C. graminicola* and fairly so to *P. graminis*; Schlägler is sufficiently resistant to snow mould, but susceptible to rust; Lurnfelder is less resistant to snow mould than the foregoing, but more so than most other varieties, and its pseudo-resistance (escape through early maturity) to rust is of great importance. Rust resistance is also the decisive factor in the cultivation of summer rye. Both in the winter and summer forms the indigenous varieties proper to almost every province should provide fruitful sources of rust-resistant (-escaping) material for crossing.

The popular Plantahof winter wheat shows adequate resistance to *P. graminis* and on this account usually gives abundant yields, but it is susceptible to cold and lodges easily. Crosses have been made between this variety and some of the Halle Plant Breeding Station selections from Thatcher [see next abstract].

Of minor importance generally in the Alps are black and crown rusts of oats [*P. g. avenae* and *P. coronata*], yellow and brown rusts of wheat [*P. glumarum* and *P. triticina*] and rye [*P. glumarum* and *P. secalina*], and dwarf rust of barley [*P. anomala*]. Wheat bunt [*Tilletia caries* and *T. foetida*] is virtually absent, or the rapid spring growth of the plants enables them to escape its attacks. Loose smut [*Ustilago tritici*] is fairly often encountered, though not to the same extent as in most parts of Germany, probably for a similar reason. Mildew [*Erysiphe graminis tritici*] also occurs in a mild form. Maize smut [*U. maydis*] is not exceptionally troublesome, but a heavy outbreak of rust [*P. maydis*] took place in 1942.

POLLACK (FLORA G.). **Fungi found on imported Australian Wheat.**—*Plant Dis. Reptr*, xxix, 8, pp. 213–214, 1945. [Mimeographed.]

The author records the results of an examination of five shiploads of Australian wheat by the Plant Quarantine officers at San Pedro, California. Three shiploads revealed seven small specimens of leaf fragments carrying flag smut (*Urocystis tritici*). Other fungi carried were *Puccinia rubigo-vera* var. *tritici* [*P. triticina*] in 17 cases, *P. graminis tritici* in five, *Tilletia caries*, *T. foetida*, and *Ascochyta graminicola* in one each, *Phoma lophiostomoides* in seven, *Selenophoma* sp. in five, wheat being apparently a new host for this fungus, and *Septoria tritici* in 17. A fragment of smutted barley spike represented apparently a specimen of *Ustilago hordei*.

CLARK (J. A.). **Registration of improved Wheat varieties, XVI, XVII.**—*J. Amer. Soc. Agron.*, xxxvi, 5, pp. 447–452, 1944; xxxvii, 4, pp. 314–318, 1945.

Four further wheat varieties were approved for registration in 1943 [cf. *R.A.M.*, xxii, p. 25] and the same number in 1944. Fairfield (Reg. No. 332), developed at the Purdue (Indiana) Agricultural Experiment Station from a cross between Purkof and Fulhio made in 1926, is a soft red winter wheat with excellent resistance to loose smut [*Ustilago tritici*] and mosaic, as well as to cold and winter-killing.

The durum varieties Carlton (Reg. No. 333) and Stewart (Reg. No. 334), both from the North Dakota Agricultural Experiment Station, are superior to Mindum and Kubanka in resistance to stem rust [*Puccinia graminis*]; the former is a selection developed in the course of a programme of back-crossing Vernal emmer to Mindum durum, while Stewart was derived from the progeny of Mindum × Vernal emmer back-crossed to Mindum.

The hard red spring Newthatch (Reg. No. 335), produced at the Minnesota Agricultural Experiment Station by back-crossing between Thatcher as the recurring and Hope as the non-recurring parent, closely resembles Thatcher in plant and kernel type, but excels it in yield and in resistance to leaf [*P. triticina*] and stem rusts.

The soft red winter Sanford (Reg. No. 336) was selected at the Georgia Experi-

ment Station from a P1068 × Purplestraw backcross. It is moderately resistant to *P. triticina* and more prolific than Purplestraw. Some 45 per cent. of the Georgia wheat crop in 1943–4 consisted of Sanford, which is also grown in Alabama and South Carolina.

Mida (Reg. No. 338) was derived at the North Dakota Agricultural Experiment Station from a Ceres-Double cross (R.L. 625) × Mercury cross. It is a hard red spring wheat, resistant to both stem and leaf rust, as well as to bunt [*Tilletia caries* and *T. foetida*], and yields well.

Orfed (Reg. No. 339) is a bunt-resistant white wheat developed at the Washington Agricultural Experiment Station from an Oro × Federation cross.

Chester (K. S.) & Larsh (H. W.). **Forecast of serious Wheat leaf rust epiphytotic.** —*Plant Dis. Reptr, Suppl.* 156, pp. 142–144, 1945. [Mimeographed.]

During 1944–5, exceptionally favourable late winter and early spring weather in Oklahoma permitted such an increase in wheat leaf rust (*Puccinia rubigo-vera* var. *tritici*) [*P. triticina*] that a severe epiphytotic, perhaps equal in intensity to that of 1938, is expected. On 1st April, at the end of the 'critical month' [cf. *R.A.M.*, xxi, p. 481; xxiv, p. 11] and the beginning of the period when temperatures and moisture are regularly favourable for rust reproduction in Oklahoma, there was more than 17,000 times as much rust present as on a corresponding date in the light rust year, 1944. This intensity and a marked increase in the following ten days were associated with the fact that on 23 of the previous 24 days the temperature for a large part of the day was between 60° and 65° F., which is an optimum for rust reproduction. Spores were being deposited on traps at Stillwater in March, 1945, with a frequency that was not reached until mid-May in 1944.

Only on one day in February and March, 1945, when observations were taken every ten days, was there any marked decrease in infection. This was on 11th March, and was due to a temperature of 21° on 6th and 7th March, which destroyed the heavily rusted leaves, and reduced foliation from an average of 5 to 3½ leaves per tiller.

In the event of a rust epiphytotic, however, the substantial acreages of moderately resistant varieties, such as Comanche, Austin, Pawnee, and Westar now under cultivation in the south-west may demonstrate their value.

Wells (J. G.), Clanahan (D. L.), & Churchill (B. R.). **Regent Wheat for the Upper Peninsula.**—*Quart. Bull. Mich. agric. Exp. Sta.*, xxvii, 3, pp. 298–300, 1945.

The authors claim that Regent beardless red spring wheat, derived from H 44 (Marquis × Vernal Emmer) and Reward (Marquis × Prelude), is highly resistant to stem and leaf rusts [*Puccinia graminis* and *P. triticina*], is stiff-strawed, and meets market and feeding requirements on the Upper Peninsula. Yield tests in 1941 gave Regent 32·4 and Thatcher 19·8 bush. per acre, while in 1944, nine of 17 farmers testing Regent wheat harvested 30 bush. per acre and over.

Craigie (J. H.). **Epidemiology of stem rust in Western Canada.**—*Sci. Agric.*, xxv, 6, pp. 285–401, 6 figs., 2 diags., 1 graph, 4 maps, 1945.

In this detailed account of an investigation (part of which was begun in 1918) into the epidemiology of wheat stem rust (*Puccinia graminis*) in Western Canada, the author states that the disease regularly appears in southern Manitoba, usually in the Red River Valley, first, and farther to the north and west afterwards. In Manitoba it occurs in late June or early July, whereas in Alberta its appearance is a month or more later. The area most severely affected comprises Manitoba and eastern Saskatchewan. There are virtually no local sources of infection. Barberry had been eradicated before the investigation began and no case of overwintering

has ever been established, though a small percentage of uredospores may occasionally survive the winter. All spore viability appears to have been lost before the new growth of grasses or cereals becomes available for infection. Inoculum is nearly always present in the air over Manitoba, usually first over the Red River Valley, before it is present over Saskatchewan, and over Saskatchewan before it is present over Alberta. In any district, inoculum has always been found present in the air in advance of infections in the field. The initial inoculum consists largely, if not wholly, of spores originating outside Western Canada, though from time to time subsequent spore invasions arrive to increase the locally-produced inoculum that has arisen from infections by the earlier wind-borne spores. The similarity, each year, in the amount of infection and in the physiologic races present in Western Canada and the Northern Mississippi Valley indicates that most of the wind-borne inoculum originates in the latter area.

An evident association exists between years of high spring and summer rainfall and years of medium and heavy infection, dependent, apparently, mainly on the amount of inoculum present. The excess rainfall of the years of medium and heavy rust over that of years with light rust is spread over the period April to August, the April to May and the July rainfall being, however, more consistently above the average than the June and August rainfall. Years with a more than average number of days with rain in spring and summer seem to be associated with years of medium and heavy infection, this association depending, apparently, on the amount of available inoculum. The frequent occurrence of nights with heavy dew in Western Canada is an important factor in promoting infection.

During the growing season, the mean temperature in Western Canada tends to be slightly higher in light than in heavy rust years, but somewhat lower than in medium rust years. The mean July temperature, however, in the area of severe rust was rather higher in the heavy than in the light rust years. The mean minimum temperature for the period 20th June to 4th August, when infection develops and spreads most rapidly, was rather higher in the heavy and medium than in the light rust years. The main effect of the lower minimum temperature in the light rust years is probably to retard rust development rather than to decrease the number of infections.

In Manitoba there was a close association between the occurrence of a south wind and that of high stem rust and leaf rust (*P. triticina*) spore concentrations in the air from 12th June to 20th July. This association was less apparent in Saskatchewan and seemed largely to disappear in Alberta. On the whole, winds favouring the introduction of spores into Western Canada did not appear to be more frequent or more lasting in heavy than in light rust years.

Factors contributing to the occurrence of more frequent and severe outbreaks of stem rust in Manitoba and eastern Saskatchewan than in western Saskatchewan and Alberta include the closer proximity of the first two areas to the source region of inoculum, the greater number of hours there during which winds blew that favoured the introduction of inoculum, and higher rainfall and temperature of these areas.

The data of appearance of field infections appears to be determined by the date of inoculum arrival and subsequent weather conditions. To a considerable degree, the establishment of epidemic conditions appears to depend on the early arrival of a copious supply of wind-borne inoculum. In medium rust years, wind-borne inoculum became plentiful much later than in heavy rust years, and in light rust years it was, with one exception, not abundant at all, or became so only late in the season.

As regards the length of time required for the crop to mature, there was little, if any, difference between heavy and light rust years. In heavy rust years, however, seeding was generally a few days later than usual, and as infection appeared at

about the usual time and increased rapidly, the crop became subjected to severe attack during most of its fruiting period. In medium rust years, moderate to severe infection was established only after the fruiting period of most of the crop was at least half completed. The popular view that heavy infection is often preceded by a period of moist, warm weather appears to be in keeping with the evidence.

PUGSLEY (A. T.). **Breeding for bunt resistance in Australian Wheats.**—*J. Aust. Inst. agric. Sci.*, xi, 1, pp. 28–34, 1945.

Studies carried out in South Australia since 1939 to determine the relative resistance to bunt (*Tilletia levis* and *T. tritici*) [*T. foetida* and *T. caries*] of the newer Australian wheat varieties in comparison with older varieties and others from America, using a mixed inoculum consisting of various races of fungi, consistently showed that the Australian varieties were not more resistant than Florence. All the Hope crossbreds tested were susceptible. Warigo (Nabawa × Hope) was rather more resistant than Nabawa but more susceptible than Hope. Many of the American varieties tested were resistant, and some of these have been used by Australian breeders, but their resistant genes have not yet been incorporated in commercial varieties. That varieties known to be resistant to certain races of bunt, such as Albit, Martin, and White Federation 38, should have proved susceptible in the author's experiments indicates the presence in Australia of races able to infect them. With these varieties, the infection figure of 20 to 30 per cent. was raised to 70 to 80 per cent. by re-inoculations from infected plants of the same variety. Similar attempts to raise the infection rating for varieties such as Hope, Rio, Oro, and Florence failed, indicating the absence of races capable of attacking these wheats severely. The tetraploid wheats tested, except Doubbi, were quite susceptible. In trials at the Waite Institute, Doubbi has always remained immune from bunt, flag smut [*Urocystis tritici*], and loose smut [*Ustilago tritici*], and is being used in crosses with *vulgare* wheats. Rye remained immune from bunt in all tests, and of two wheat-rye hybrids tested, Secalotricum 144 was immune, while Secalotricum 200 was fully susceptible.

Nine collections of *T. foetida* from South Australia were found to correspond with Rodenhiser and Holton's race L–1 [*R.A.M.*, xvii, p. 165], as did a bulk collection from Temora, New South Wales. Three other collections of *T. foetida* were examined. One, derived from a single plant of Selection 1403, resembled race L–3, the second, from a single plant of Martin, resembled L–4, and the third, a bulk collection from Sydney, also resembled L–4.

Of three collections of *T. caries*, one, from a single head of White Federation, resembled T–5 or T–7, the second, from a single head of Ranee, resembled T–2 except for the intermediate reaction of Mindum, and the third, a bulk collection from Western Australia, appeared to resemble Ranee.

In the bunt-resistance breeding work in progress, Oro has been selected as the main parent, as it is susceptible only to race L–8 and has always been highly resistant to the Australian races tested. Preliminary tests have shown it to possess a major gene for resistance to the local race L–1. Using Oro, White Federation 38, and Selection 1403 (the two last-named also being resistant to L–1) as parents in crosses with other varieties, a number of F_3 lines homozygous-resistant to L–1 have been obtained. Preliminary tests showed Doubbi to possess a major gene for resistance, and *vulgare*-like resistant lines have been obtained from (Ranee × Doubbi) × Ranee, which are being used as parents in further back-crosses.

LITZENBERGER (S. C.). **Compana and Glacier Barley. Two new varieties for Montana.**—*Bull. Mont. agric. Exp. Sta.* 422, 17 pp., 1 fig., 1944.

Two superior barley varieties, Compana and Glacier, have been released by the Montana Agricultural Experiment Station, the former designed to replace Horn

on non-irrigated lands and the latter as a substitute for Trebi on irrigated and relatively moist non-irrigated soils. The average percentages of covered smut (*Ustilago hordei*), the most destructive disease of the crop in the State, over the period from 1940 to 1942 in Glacier, Compana, Trebi, and Horn were 0·0, 5·7, 15·1, and 9·8, respectively. Glacier has been observed to be susceptible to loose smut (*U. nuda*), but no infected plants were found in Compana.

Yu (T. F.). **Reaction of improved Millet varieties to infection with downy mildew (Sclerospora graminicola Schroet.)**—*Chin. J. sci. Agric.*, i, 3, pp. 199–203, 1944. [Chinese summary.]

From 1934 to 1936 inclusive, inoculation experiments were carried out at Nanking to determine the reactions to downy mildew (*Sclerospora graminicola*) of five improved foxtail millet [*Setaria italica*: *R.A.M.*, xviii, p. 174] varieties, namely, Tsinan-Nanking No. 2, Kaifeng No. 48, and Nanking Nos. 19, 26, 60, the resistance of which to kernel smut (*Ustilago crameri*) had previously been established [ibid., xvi, p. 741]. Only the first-named proved to be resistant to downy mildew, with an average incidence for the three-year period of 5·7 per cent., the corresponding figures for the other varieties in the foregoing order being 11·6, 16·2, 22·9, and 12·7 per cent., respectively, and for a susceptible variety used as a control 34·4. Tsinan-Nanking No. 2, moreover, remains highly resistant even when sown in a naturally infested field, under which conditions the moderately resistant Kaifeng No. 48 produces a certain number of diseased plants. The former may safely be distributed in the regions of North China where downy mildew is widespread and destructive, whereas the latter requires further improvement for this purpose.

Halma (F. F.), Smoyer (K. M.), & Schwalm (H. W.). **Rootstock in relation to quick decline of Citrus.**—*Calif. Citrogr.*, xxx, 5, pp. 150–151, 1 diag., 1945.

The authors consider that quick decline, the sudden wilting of foliage and eventual breakdown or death of Navel and Valencia orange trees, is confined to sour orange rootstocks [*R.A.M.*, xxiii, p. 483]. In orchards where there are declined trees on sour stock, trees on sweet stock have been found unaffected. Susceptibility of trees on sour stock and resistance of trees on sweet stock may tentatively, therefore, be assumed as reasonable. The relatively small number of trees on grapefruit stock do not show signs of this disease, which may suggest a quality of resistance in this stock. In three orchards on [*Poncirus*] *trifoliata* stock no disease was observed though a few on sour stock have become affected. In one orchard lemon trees were unaffected, whereas Navel and Valencia orange trees wilted considerably. Three methods were used in identifying the rootstock species, viz., (1) rootstock sprouts, (2) the type of bud union, and (3) the chemical method (*Plant Physiol.*, iv, pp. 265–268, 1929).

Camp (A. F.). **Relatório de observações científicas no Brasil.** [Report of scientific observations in Brazil.]—*Bol. Curs. Aperf. Espec.* 1, 18 pp., 1943. [Received May, 1945.]

During a visit to Brazil, the author (Horticultural Director of the Citrus Experiment Station, Lake Alfred, Florida), made a number of observations in the States of Rio de Janeiro and São Paulo relating to the form of root rot associated with the maladjustment of the sour orange stocks to the prevailing climatic and soil conditions, regarded as the most plausible explanation of the trouble [*R.A.M.*, xxiv, pp. 98, 227], and on the mineral deficiencies of citrus, notably zinc (which was widespread in all the areas inspected), copper, and phosphorus.

The zinc and manganese contents of the soils in all the coffee plantations visited were inadequate.

Dastur (R. H.), Singh (M.), & Singh (S.). **Studies in the periodic partial failures of the Punjab-American Cottons in the Punjab. XII. Further experiments on the amelioration of tirak.**—*Indian J. agric. Sci.*, xiv, 3 pp. 181–195, 1944.

This paper presents in detail the results of many years' experiments on tirak disease of cotton in the Punjab [*R.A.M.*, xxiv, p. 227]. At the fruiting stage extra water reduces tirak and gives higher yields on soils with saline subsoils, where nitrogen is quite ineffective. Nitrogen reduces tirak and raises yields on light, sandy, non-saline soils, where the response to heavy watering is small.

On sandy soils which are deficient in nitrogen but have saline or alkaline subsoils, nitrogen does not assist the opening of bolls, though it encourages bearing. American cottons sown in May are liable to tirak, June sowing gives better yields, provided that close spacing is carried out. Late sowing is a measure of great practical value because it is very difficult for a zamindar to distinguish the soil conditions causing tirak. Two schedules have been drawn up giving details of the seed rate and spacing in relation to the sowing date and of the optimum sowing dates in different districts of popular varieties.

Karling (J. S.). **New Lagenidiaceous parasites of rotifers from Brazil.**—*Lloydia*, vii, 4, pp. 328–342, 107 figs., 1944.

In the course of a study on the Chytrids of Brazil (*Bull. Torrey bot. Cl.*, lxxi, 4, pp. 374–389, 1944; *Amer. J. Bot.*, xxxi, pp. 254–261, 1944), the author observed three new Lagenidiaceous parasites of rotifers in water and soil samples collected in various regions of the Amazon Valley, namely *Lagenidium microsporum*, *L. parthenosporum*, and *L. distylae*, all on *Distyla* sp., and the second also on *Philodina* sp., *Chaetonotus larus*, and *Heterodera* sp.

Drechsler (C.). **Several additional Phycomycetes subsisting on nematodes and amoebae.**—*Mycologia*, xxxvii, 1, pp. 1–31, 4 figs., 1945.

Continuing his earlier studies [cf. *R.A.M.*, xxiii, p. 485], the author gives a full account of four new species of Phycomycetes, namely *Cochlonema intercalaris* capturing nematodes, *C. ozotum*, destructive to the protozoan *Sphenoderia dentata*, and *Stylopage minutula* and *Acaulopage dichotoma* capturing amoebae.

Millikan (C. R.). **A 'false' browning reaction to rust (Melampsora lini) infection in Flax.**—*J. Dep. Agric. Vict.*, xliii, 2, pp. 83–91, 10 figs., 1945.

A browning on flax identical with the disease called 'false' browning in New Zealand [*R.A.M.*, xxiii, p. 437] occurred in a severe form in the Strathkellar and Kooweerup districts of Victoria and in a milder form elsewhere. There appeared to be no relation between time of sowing and subsequent development of browning in five crops investigated. The disease first appeared in well-grown crops up to 30 or 40 in. or more high, about the beginning of November before the plants begin to ripen off, and affected both the varieties Concurrent and Liral Crown.

'False' browning patches may be only a few square yards in area and the disease develops simultaneously in a few days over the whole patch, no spread taking place subsequently to adjacent plants. Diseased plants in the mass show a brick-red colour, which is not typical of plants affected by browning disease due to *Polyspora lini* [ibid., xxi, p. 334]. The elongated, reddish-brown discolorations on the stems are usually confined to the upper half of affected plants. Individual lesions usually coalesce so that the whole of the upper portion of the stem is affected. The border is not obviously darker than the remainder and thus serves further to distinguish this disease from *Polyspora* browning. On the leaves the lesions are darker in colour, and where a large area is affected the leaf becomes twisted and drops off. Leaf lesions are often the only manifestation of the disease and often in mild cases no obvious discoloration can be detected. 'False' browning lesions occur usually

round rust (*Melampsora lini*) pustules which are abortive and white in colour due to a complete absence of uredospores. Badly affected plants produce little or no seed, but the effect on fibre yield and quality is not known at present.

In each case reported the disease occurred about a week after sudden hot spells with shade temperatures of 80° F. or over. Lesions identical in appearance with those of natural 'false' browning have been produced around rust pustules on the leaves and stems of plants subjected to a constant temperature of 37° C., and a relative humidity of approximately 85 per cent. for periods of from 6 to 30 hours. The browning was well developed approximately three days after this treatment. The most vigorous reactions occurred around very immature uredospore pustules and after the longest exposures to the heat treatment. Little 'false' browning occurred round teleutospore pustules, although such pustules lost the uredospores remaining in the centre and becoming abortive. The heat treatment had no effect on the uninfected tissues of the plants. Histological studies showed that the appearance of tissues affected with 'false' browning in artificially heated and natural specimens was identical. The browning was due to necrosis of the cells associated with a dense mycelial infection. The tips of the hyphae were often swollen to form miniature bodies which, except for their size, resembled uredospores or teleutospores. No such bodies were detected in normal rust-infected leaf tissue.

McCallan (S. E. A.). **Evaluating fungicides by means of greenhouse Snapdragon rust.**—*Contr. Boyce Thompson Inst.*, xiii, 8, pp. 367–383, 5 graphs, 1944.

In this paper the author describes a greenhouse method devised to evaluate the properties of foliage fungicides against snapdragon (*Antirrhinum niger*) [*A.* ?*majus*] rust (*Puccinia antirrhini*), the technique employed being the same as with tomato foliage diseases [*R.A.M.*, xxiii, p. 34]. The potted plants (Cheviot Maid Supreme variety) were trained to twin stems and were found to be at their best for testing when 12 in. tall. The total number of pustules per 20 leaves was counted, these leaves being composed of the five adjacent paired leaves on each stem showing the greatest number of pustules. The optimum time for counting was ten days after inoculation. There was little difference in the amount of infection that occurred between 5° and 20° C., and no significant difference between 10° and 15°. Satisfactory tests may be made within the former range. Spores were obtained from vigorous, unsprayed, previously infected plants, a concentration of 100,000 spores per c.c. producing about 300 pustules per 20 leaves.

In tests with Bordeaux mixture, cuprocide, Tennessee copper 34, lime-sulphur, flotation sulphur, mike sulphur, fermate, thiosan, and spergon, the dosage response curves plotted as straight lines on logarithmic probability paper. Empirical probit weights were obtained not significantly different from those previously calculated for greenhouse tomato diseases [loc. cit.]. This indicated greatest precision in the vicinity of the L D_{95} level of control.

The organic fungicides gave the steepest dosage response curves and the most effective control, the sulphur compounds were intermediate, while the copper fungicides had flat slopes and were ineffective. The results may preferably be expressed as per cent. dosage to give 95 per cent. control, i.e., the L D_{95}, or as per cent. disease at a spray dosage of 0·2 per cent. In exploratory tests the method of classifying developed for tomato diseases [loc. cit.] may be used.

Absolute comparisons with laboratory slide-germination tests showed that the sulphur fungicides were rated in the same order and with approximately similar L D_{95} values and slopes of dosage-response curves. The organic compounds were rated in the same order, but were rather more effective in the greenhouse and had steeper curves in the laboratory. The copper fungicides also had steeper curves, but were rated as very effective in the laboratory.

Creager (D. B.). **Mosaic of the common Coleus.**—*Phytopathology*, xxxv, 4, pp. 223–229, 2 figs., 1945.

Greenhouse and outdoor plantings of 40 varieties of *Coleus blumei* in Illinois have been observed during the last three years to suffer from a mosaic disease causing foliar mottling, splotches, ring spots, oak-leaf patterns, and hieroglyphic markings. Grafting experiments on the Gold Bound variety clearly identified the pathogen as a transmissible virus, 24 out of 28 having been successful in the first and 75 out of 75 in the second series. All attempts at mechanical transmission having failed, it is suggested that insects may act as vectors of the virus in nature.

Creager (D. B.). **Rhizoctonia neck rot of Gladiolus.**—*Phytopathology*, xxxv, 4, pp. 230–232, 2 figs., 1945.

A neck rot of *Gladiolus* has been observed for several years past in commercial plantings in Kanakee County, Illinois, destroying the plants in long (up to 6 or 7 ft.), continuous sections of the rows and causing losses estimated mostly at under 25 but sometimes reaching 100 per cent. The Rewi Fallu, Picardy, Giant Nymph, Opalescent, Pearl Harbor, Dr. F. E. Bennett, and Flaming Sword varieties are highly susceptible, but some indication of resistance has been given by Queen of Bremen. The symptoms usually appear early in May, when brown, necrotic lesions are formed on the leaf bases, about 1 in. below soil-level. The succulent, interveinal parenchyma tissues undergo disintegration, which results in the shredding of the leaf bases, and most or all of the aerial system of the plant wilts and ultimately dies. The leaf sheaths and corm scales may be destroyed, and long, narrow, brown lesions, imparting a horizontally striped appearance, develop on the corms at the points of attachment of the infected scales. The organism isolated from fresh lesions is assumed, on the evidence of comparative cultural studies and inoculation experiments on two of the above-mentioned varieties, to be a strain of *Rhizoctonia* [*Corticium*] *solani* similar to the forms infecting potato, poinsettia [*Euphorbia pulcherrima*], and carnation.

Mitra (A. K.). **Melanopsamma ranjanii sp. nov.: a new parasite of Selaginella.**—*J. Indian bot. Soc.*, xxiii, 4, pp. 158–163, 1 pl., 1 fig., 1944.

A full description is given of *Melanopsamma ranjanii* n.sp., a parasite of *Selaginella chrysocaulos* in the Lloyd Botanical Gardens, Darjeeling [*R.A.M.*, xxiii, p. 300].

Jones (F. R.). **Ascochyta meliloti (Trel.) Davis as the conidial stage of Mycosphaerella lethalis Stone.**—*Trans. Wis. Acad. Sci. Arts Lett.*, xxxv, pp. 137–138, 1943. [Received April, 1945.]

The conidial stage of *Mycosphaerella lethalis*, the agent of black-stem disease of sweet clover (*Melilotus* spp., including *M. dentata*), has hitherto been referred to *Ascochyta lethalis*, but recent information renders this identification untenable. *A. lethalis* is a synonym of *A. caulicola* [*R.A.M.*, xviii, p. 35], which is not the conidial stage of *Mycosphaerella lethalis* but a distinct species without a known ascigerous phase. It is not readily distinguishable from the imperfect stage of *M. lethalis* by the usual mycological characters, but may easily be differentiated on a cultural basis and usually by its pathological effects on the host. An examination of the original collection of *A. meliloti* (Trel.) Davis from the Missouri Botanic Garden corroborated the opinion of J. A. Stevenson that this represents the conidial stage of *M. lethalis*. An emended description of *A. meliloti* is given. The globose pycnidia measure 100 to 150 μ in diameter and the oblong or slightly curved, unequally divided conidia 13 to 20 (mostly 15 to 18) by 5 to 6 μ.

Teakle (L. J. H.). **Molybdenum as a fertiliser in Western Australia.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xxi, 4, pp. 335–339, 2 figs., 1944.

During 1944, over 30 tests were carried out in different localities in Western Australia on the response of plant growth to soil applications of molybdenum [cf. *R.A.M.*, xxiv, p. 105] as roasted molybdenite. Subterranean clover was used in most cases as the test plant, and ironstone gravelly soils [cf. ibid., xxii, p. 27] were included wherever possible.

Only on one site was any marked response to the molybdenum observed. Here the molybdenum content of the subterranean clover leaves as p.p.m. air-dry material was 0·4 on the treated strips and 0·1 on the untreated, the corresponding figures for the remaining localities ranging from 0·1 to 8·9, and 0·1 to 0·7. These results do not support the view of Stephens and Oertel that 1 p.p.m. is the normal molybdenum content of subterranean clover [ibid., xxii, p. 484], and indicate the need for further research on this point under Western Australian conditions.

Jones (L. T.) & Elliott (H. G.). **Copper deficiency in the Busselton-Augusta district. A review of its history and investigation with special reference to the re-establishment of Subterranean Clover.**—*J. Dep. Agric. W. Aust.*, Ser. 2, xxi, 4, pp. 342–357, 5 figs., 1944.

In this review of the early history of copper deficiency in the soils of the Busselton-Augusta area of Western Australia [cf. *R.A.M.*, xxiii, p. 148] the authors show that the use of copper sulphate or its equivalent as other sources of copper-containing material on copper-deficient land, usually at the rate of 10 lb. per acre, has produced the following beneficial results: (1) following re-seeding, it has induced a quick regeneration of subterranean clover on previously 'stalled' areas, (2) it has increased the copper content of the pasture, with resultant improvement in the health of the stock grazing thereon, and (3) it has increased the carrying capacity of the 'stalled' areas. In most cases, one application appeared to be effective for at least four years.

Hyde (E. O. C.). **Ryegrass seed: pre-harvest examination for blind-seed disease and estimation of germination capacity.**—*N.Z. J. Agric.*, lxx, 3, pp. 271–276, 16 figs., 1945.

In this well-illustrated paper, the author, after briefly describing the life-history of the blind-seed fungus [*Phialea temulenta*: *R.A.M.*, xxiv, pp. 151, 234] of rye grass [*Lolium perenne*] in New Zealand, and the detection of the disease in the laboratory, recommends that samples of the crop should be taken and sent to the Seed Testing Station, Palmerston North [cf. ibid., xxii, p. 171], two to three weeks after flowering and again when the seed is mature.

Reports on immature samples give the proportion of seeds infected up to the time of examination, an indication of the stage of development of the seed, and enable recommendations on subsequent sampling to be made. In reports on mature seed, an estimate of the germinating capacity is given. Such estimates are reasonably reliable, provided the cutting proceeds without much delay. The chief value of these reports is that they enable growers to avoid harvesting crops that are almost worthless because of low germination. The information provided enables a grower to estimate the value of his seed crops and adjust his harvesting programme accordingly.

Allison (J. L.). **Selenophoma bromigena leaf spot on Bromus inermis.**—*Phytopathology*, xxxv, 4, pp. 233–240, 1 fig., 1945.

The leaf spot of *Bromus inermis*, an important forage and pasture grass in the north-central United States, caused by *Selenophoma bromigena* (syn. *Septoria*

bromigena) [*R.A.M.*, xviii, p. 742; xxi, p. 144] is generally distributed but apparently specific to the one host, artificial inoculation experiments on other grasses, including *B.* spp. and cereals, having given negative results. The symptoms are typical of those associated with the genus on other Gramineae and consist in the formation on the lower leaves, soon after the onset of growth in the spring, of oblong, chlorotic lesions, 8 to 15 mm. in length, which in about a week turn light brown with a dry centre and pale red margin and may coalesce under humid, cool conditions to cover large areas of the surface. The sheath, stem, rachis, panicles, and glumes may also become involved. In severe cases the plants may be stunted or even killed.

No perfect stage of the pathogen has been found, and overwintering is presumed to be effected by means of the pycnidia. Ingress to the leaf is gained directly through the epidermis, chiefly of the upper surface. Resistant individuals of *B. inermis* are common, so that control of the leaf spot by selection and breeding offers hopeful possibilities. Evidence of physiologic specialization was forthcoming.

Monospore isolates of *Selenophoma bromigena* grew best on potato dextrose agar at 20° to 25° C. Occasional cultures produced variants which failed to give rise to pycnidia or conidia and could only be perpetrated by mycelial subtransfers. They remained constant for two years through repeated subcultures. The variants were non-pathogenic.

Chamberlain (D. W.) & Allison (J. L.). **The brown leaf spot on Bromis inermis caused by Pyrenophora bromi.**—*Phytopathology*, xxxv, 4, pp. 241–248, 1945.

The fungus responsible for a brown leaf spot of *Bromus inermis* observed at the Wisconsin Agricultural Experiment Station in 1941 was identified as *Pyrenophora bromi* (*Helminthosporium bromi*) [*R.A.M.*, iii, p. 65]. The symptoms of the disease conform essentially to those originally described by Diedicke from Germany (*Zbl. Bakt.*, Abt. 2, ix, pp. 317–329, 1902; xi, pp. 52–59, 1903) and corroborated by Drechsler. Minute, dark brown, scattered specks appear on the young leaf blades and gradually become encircled by a yellow halo. The lesions expand, especially in a longitudinal direction, and often coalesce to form large, chlorotic areas, this process being followed by generalized yellowing and withering of the foliage. The morphological characters of *P. bromi* likewise agree with the diagnoses of the above-mentioned authorities.

The fungus was shown by host-range studies to be specific to *B. inermis*, inbred lines of which differed in their reactions, some being altogether susceptible and others highly resistant. Overwintering takes place in the perithecial stage and the bulk of the inoculum is provided by ascospores; the few conidia produced are fragile and short-lived. Both spore forms germinated over a temperature range from 4° to 32° C., the optimum for the ascospores being 20° and for the conidia 28°. *P. bromi* is homothallic, the ascigerous stage having been repeatedly produced by the exposure to monoascospore potato dextrose agar cultures to low temperatures (4° to 12°) for three months.

Invasion of the host is effected by direct penetration of the foliar epidermis and the fungus then establishes itself by ramifying in the intercellular tissues. Cool, humid conditions are conducive to the spread of the disease.

Ahlgren (H. L.), Smith (D. C.), & Nielsen (E. L.). **Behaviour of various selections of Kentucky Bluegrass, Poa pratensis L., when grown as spaced plants and in mass seedings.**—*J. Amer. Soc. Agron.*, xxxvii, 4, pp. 268–281, 1945.

The principal diseases affecting Kentucky bluegrass (*Poa pratensis*) in investigations covering the period from 1936 at the Wisconsin Agricultural Experiment Station were leaf spot (*Helminthosporium vagans*) [*R.A.M.*, xxii, p. 99], leaf rust (*Puccinia rubigo-vera* and *P. poae-sudeticae*) [ibid., xxii, p. 313], and mildew

(*Erysiphe graminis*), while stripe smut (*Ustilago striiformis*) [ibid., xxiv, p. 277] affected certain selections in 1942 and 1943. The pathogens developed more extensively in space-planted nursery rows than in mass seedings: under the latter conditions there was little or no relation between yields and disease reaction.

Plant diseases. Notes contributed by the Biological Branch.—*Agric. Gaz. N.S.W.*, lvi, 3, pp. 113–115, 120, 5 figs., 1945.

In this paper a general, purely tentative, account is given of the decline and die-back of deciduous fruit trees that is causing concern to growers in many parts of New South Wales. There are numerous causes of the condition, but the symptoms are often so similar that it is, as a rule, impossible to diagnose any particular case without a detailed knowledge of the orchard and a first-hand examination of the affected trees. Further, the nature and relative importance of some of the causal factors are as yet little understood. Detailed investigations are, however, being made.

General decline, followed by dying-back of the limbs, and accompanied by a characteristic ridge along the main branches of stone fruit trees, with a sour smell of fermenting sugars, is due to the fruit-tree root weevil [*Leptops squalidus*]. Root-rotting fungi, of which *Armillaria* is the most important and widespread, cause a general decline with resultant die-back. Several organisms attack the trunks and limbs and cause cankers, which by girdling the branch produce die-back. These can often be distinguished by the exudation of gum from the cankers of stone fruits, but on pome fruits gum is not produced. The most important of these diseases are gummosis and die-back of cherries [associated with *Pseudomonas mors-prunorum*: *R.A.M.*, xviii, p. 746] and bacterial canker of apricots [ibid., xxi. p. 281] and, possibly, other stone fruits. Several wood-rotting organisms, such as *Schizophyllum*, *Polystictus*, and *Fomes*, are responsible for die-back, entering the trees through wounds or sun-scalded areas of the bark. A substantial proportion of the cases of die-back found appear to be due to nutritional disturbances, while environmental factors, such as waterlogging and sun scald, are also suspected of causing decline. Finally, incompatibility of certain stocks with commercial varieties results in poor growth and death of the tree. This is particularly the case with some plum stocks. When this occurs, there is usually a general decline of the whole tree, and differences in diameter between stock and scion are readily perceptible.

Hilkenbäumer (F.). **Resistenzzüchtung bei Obstunterlagen.** [Breeding for resistance in fruit stocks.]—*Kühn-Arch.*, lx, pp. 455–461, 1944.

In connexion with the German programme of breeding fruit stocks for resistance to frost, insect pests, and pathogenic micro-organisms, mention is made of some important studies, already referred to in this *Review*, on the development of apple varieties resistant to crown gall (*Pseudomonas* [*Bacterium*] *tumefaciens*), scab (*Venturia inaequalis*), and powdery mildew (*Podosphaera leucotricha*), and cherries and peaches resistant to gummosis of physiological origin.

Christopher (E. P.) & Pieniazek (S. A.). **Influence of sulphur sprays on the trunk diameter of young Apple trees (second report.)**—*Proc. Amer. Soc. hort. Sci.*, xliv, pp. 99–100, 1944.

The following were the diameters (in inches) in December, 1943, of young McIntosh apple trees after five years' treatment against scab [*Venturia inaequalis*] by various spraying programmes at the Rhode Island Agricultural Experiment Station [*R.A.M.*, xxi, p. 530]: lime-sulphur (day), 3·21, ditto (night), 3·20, ditto 1 in 100 (day), 3·45, ditto 1 in 50 (two applications), followed by flotation sulphur paste 10 lb. in 100 gals., 3·39, ditto 1 in 50 (two applications), followed by kolofog

6 in 100, 3·37, flotation sulphur paste 10 in 100, 3·51, sulphur dust, 3·50, and control, 3·11, the corresponding figures for Baldwin being 2·82, 2·93, 3·39, 3·24, 3·42, 3·27, 3·48, and 3·27 respectively. It is apparent from these data that, in the case of the scab-susceptible McIntosh, all the treatments except lime-sulphur at the lower strength were significantly better than none, and that the results reflect the damage done by scab, whereas the resistant Baldwin reacted unfavourably to the weak lime-sulphur and did not appreciably benefit from the other treatments. For McIntosh a dust or wettable sulphur is recommended, but Baldwin, which is very susceptible to spray injury, probably needs little fungicidal treatment during the first five years in the orchard.

Pieniazek (S. A.) & Christopher (E. P.). **The effect of some new spray materials on the rate of apparent photosynthesis of Apple leaves.**—*Proc. Amer. Soc. hort. Sci.*, xliv, pp. 105–106, 1944.

The results of tests at the Rhode Island Agricultural Station in 1943 to determine the effect of fermate (1½ lb. with the same quantity of hydrated lime in 100 gals. water) and Q_1 (lauryl pyridinium chloride) at a strength of 1 in 5,000, applied to Baldwin apple trees against scab [*Venturia inaequalis*], on foliar photosynthesis [cf. *R.A.M.*, xv, p. 726] are summarized and tabulated. The former preparation was applied in five series between 18th May and 17th July and the latter in three between 17th August and 7th September; the computations of carbon dioxide assimilation (in mg. per 100 sq. cm. per hour) were made on leaf pairs from two trees, one sprayed and the other untreated. In the fermate trials, the average assimilation of the treated leaf pair ranged from 6·06 (at 92° F.) to 16·03 (57°) compared with 7·73 (90°) to 17·61 (57°) for the control, the corresponding values in the Q_1 tests being from 9·20 (72°) to 10·70 (77°) and 11·01 (77°) to 13·47 (95°), respectively. It is evident from these results that Q_1 does not reduce the rate of apparent photosynthesis as much as does fermate. Neither material is as injurious as lime-sulphur in its effects on carbon dioxide assimilation even at high temperatures, and under cooler conditions the retardation from this source is inconsiderable.

Teske (A. H.) & Zielinski (Q.). **The use of fermate for the control of bitter rot and Cedar rust of Apple.**—*Proc. Amer. Soc. hort. Sci.*, xliv, pp. 107–108, 1944.

Of recent years considerable difficulty has been experienced in Virginia in the control of apple bitter rot [*Glomerella cingulata*] and cedar rust [*Gymnosporangium juniperi-virginianae*], and tests were accordingly carried out to determine the value of fermate for this purpose. The trees selected for the bitter-rot trials were Albemarle Pippins which had suffered severely during the past three years. Fermate was applied to one block on 9th and 22nd June, 14th July, and 4th August at the rate of 1½ lb. in 100 gals. water, with the addition on the first occasion of a mixture of bentonite and goulac, which was subsequently replaced by fish oil soap, while Bordeaux mixture (4–8–100) was used on the other. At harvest time, the percentages of diseased fruits on the fermate and Bordeaux-treated trees were 2 and 6·9, respectively, the latter being considered rather heavy for bitter rot.

The varieties used in the cedar-rust experiments comprised the highly susceptible York Imperial and Rome Beauty and the extremely resistant Grimes Golden and Stayman Winesap. Fermate (1½ in 100) plus 1 pint miscible paraffin was applied in the pink, petal-fall, and second and third cover sprays in comparison with a regular schedule consisting of lime-sulphur (8 qts. in 100 gals.) in the pink, wettable sulphur (8 lb. in 100) in the petal-fall and first cover, and 2–4–100 Bordeaux in the second and third cover sprays. The fruit of all four varieties in the fermate-treated block remained healthy, and so did the leaves of the two resistant sorts, while the amount of rust on the susceptible York Imperial and Rome Beauty foliage was negligible. In the block sprayed according to the standard programme,

Rome Beauty and York Imperial developed 6 and 2·5 per cent. fruit infection and the leaves were also severely attacked; the fruits and foliage of Grimes Golden and Stayman Winesap did not contract cedar rust.

Hough (L. F.). **A survey of the scab resistance of the foliage on seedlings in selected Apple progenies.**—*Proc. Amer. Soc. hort. Sci.*, xliv, pp. 260–272, 3 figs., 1944.

This is a tabulated account and discussion of observations at the Illinois Agricultural Experiment Station on the scab (*Venturia inaequalis*) resistance of the foliage of hybrid seedlings, orchard varieties, and crab-like forms of apples under conditions of severe natural infection [cf. *R.A.M.*, xviii, p. 399]. Several species of *Malus* [*Pyrus*], notably *M.* [*P.*] *floribunda* and *M.* [*P.*] *atrosanguinea*, appeared to be completely resistant, while Duchess and Jefferis, the most promising parents among the orchard varieties, have already produced a few highly resistant seedlings.

In crosses between orchard varieties, reaction to *V. inaequalis* is evidently determined by several cumulative factors. However, in an F_2 population of 38 trees from an original cross of Rome Beauty × *P. floribunda*, very clear-cut segregation was observed, approximating a 1 : 1 ratio for resistance versus susceptibility. A few of the seedlings from this progeny possess hopeful possibilities as parents by reason of their exceptionally attractive foliar and tree characters.

Mitchell (A. E.) & Childers (N. F.). **Further studies on effects of mild and caustic sprays on Apple leaves.**—*Proc. Amer. Soc. hort. Sci.*, xliv, pp. 111–115, 1 fig., 1 graph, 1944.

The writers' greenhouse and field tests at the Ohio Agricultural Experiment Station with a brand of mild sulphur known as kolofog, made by the absorption of fused sulphur into bentonite, lend further weight to the observations of other workers as to the relatively uninjurious character of spraying preparations of the former type compared with liquid lime-sulphur. Stayman Winesap, Turley, and McIntosh apple leaves treated with kolofog (6 lb. in 100 gals. for the earlier, and 4 lb. for the later, applications) were markedly larger than those sprayed with lime-sulphur (in fact, they are designated by local growers as 'elephant leaves'), and somewhat exceeded the dimensions of the foliage in the block receiving kolospray, a material differing from kolofog in two respects, viz., (1) only a portion of the active ingredient is bentonite sulphur, and (2) its higher sulphur content (81 per cent.). To cite some figures from the field trials, the area of leaves on ½ in. spurs of Stayman Winesap, Turley, and McIntosh growing in soil treated with kolofog were 88,848, 134,742, and 134,020 sq. cm., respectively, and their dry weights 814·4, 1,330·4, and 1,160·9 gm., respectively, compared with 79,136, 127,937, and 121,300 sq. cm., respectively, and 703·4, 1,264·9, and 1,062·8, respectively, for kolospray and 69,528, 115,789, and 92,377 sq. cm., respectively, and 641·7, 1,090·5, and 817·5 gm., respectively, for lime-sulphur.

Frear (D. E. H.), Miller (H. J.), & Fagan (F. N.). **Comparative spray deposits and scab control from speed sprayer and single-multiple gun sprayer.**—*Proc. Amer. Soc. hort. Sci.*, xliv, pp. 129–133, 1944.

The so-called 'speed sprayer', introduced in recent years as a means of reducing labour costs and expediting the application of orchard plant-protectives [*R.A.M.*, xxii, p. 490; xxiii, p. 444], consists of a series of small, low-pressure nozzles through which the spray material is discharged, a large propeller producing a strong air blast to drive the spray mist against the trees, and a series of vanes serving to direct the driven mist. The new equipment has been widely adopted by Pennsylvania fruit-growers, and in 1943 orchard trials were carried out at the Agricultural Experiment Station on Stayman Winesap and McIntosh apples to compare the

efficiency of its performance with that of the standard high-pressure sprayer. The materials applied between 26th April (delayed dormant) and 24th July (fourth cover) comprised lime-sulphur solution and dry hydrated lime, lead arsenate, nicotine sulphate, and copper sulphate.

The spray deposits produced by the speed sprayer were lower on the tops and higher on the bottoms of the trees than those from the high-pressure apparatus. This relationship was reflected in the enhanced scab [*Venturia inaequalis*] incidence on McIntosh foliage and fruits and smaller quantity of commercial packed fruit from the trees treated with the speed sprayer (63·8 as compared with 74·4 per cent. from the high-pressure rows). The operations were accomplished on an average more than twice as fast with the speed as with the standard sprayer using the same amount of labour, and further studies along similar lines are planned.

Palmiter (D. H.). **Relation of spray materials to russeting of Delicious and Golden Delicious Apples. Preliminary report.**—*Proc. Amer. Soc. hort. Sci.*, xlv, pp. 113–118, 1 graph, 1944.

To determine the part played by spray materials in inducing fruit-russeting, Golden Delicious apple trees in the Red Hook section of the Hudson Valley were sprayed during 1943 at the pink stage, in bloom, at petal-fall, and 10 and 30 days later with a number of different fungicides.

The results of these trials, together with detailed observations in commercial orchards, indicate that part of the severe russet on Golden Delicious apples and nearly all that on Delicious in the Hudson Valley in 1943 resulted from spray injury. On Delicious no russet was found on unsprayed trees at any elevation, though nearly every sprayed orchard showed considerable russet where the sprays were applied under wet conditions. The only exception was an orchard given fermate throughout the season. Golden Delicious often showed a high percentage of slight russet even on unsprayed trees, though where sulphur-lead arsenate was used the injury was increased and was of a more severe type. The use of fermate on this variety did not eliminate russet, but prevented an increase over that on unsprayed trees.

Lead arsenate without any fungicide caused almost as much russeting on Golden Delicious as the combination of wettable sulphur and arsenical, indicating that at least part of the injury is due to the arsenical. The reduced amount of russet and calyx-end injury where fermate was used with the lead arsenate indicates a corrective action by fermate when used as a spray.

The critical period for russet in 1943 was from the pink stage until two or more weeks after petal-fall. As this is also the critical period for disease development in the Hudson Valley, fermate 1 or 1½-100 applied at the pink, bloom, and petal-fall stages and ten days later should provide both disease control and freedom from russeting. The use of S.E.C. with fermate further reduced russeting and imparted an improved lustre to the fruits.

Howard (F. L.), Locke (S. B.), & Keil (H. L.). **Synthetic organic fungicides for Apples.**—*Proc. Amer. Soc. hort. Sci.*, xlv, pp. 131–135, 1 fig., 1944.

During the past two seasons members of two new generic groups of cationic organic fungicides, phenyl-mercury (puratized) and pyridine derivatives (isothan Q) [see below, p. 327], have given outstanding control experimentally against apple diseases in Rhode Island. The high fungicidal value of these materials is shown by the fact that whereas 10 lb. wettable (Camden paste) sulphur or 1½ lb. fermate are used per 100 gals. spray, about 20 gm. puratized N 5 D toxicant or 78 gm. isothan Q 15 toxicant gave equal or better control of scab (*Venturia inaequalis*). Though these materials are used on plants at 1 in 20,000 or 1 in 5,000, respectively, they have far higher potential fungicidal values. As determined by laboratory techniques, some

inhibit spore germination in test fungi to the extent of 90 per cent. or over at 1 part per million in water. Several of them have therapeutic value. For example, the McIntosh apple leaves bearing scab were sprayed with isothan 15 (lauryl isoquinolinium bromide) at 1 in 5,000 and puratized N 5 D (phenyl mercuri triethanol ammonium lactate) at 1 in 20,000. The former suppressed sporulation in 77·2 per cent. of the lesions and the latter in 76·9 per cent. In addition to reducing the amount of potential inoculum, such fungicides also reduce the amount of tissue injured on an individual leaf, so permitting a high photosynthetic level for the foliage. Also, in two years' tests, isothan Q 15 and puratized N 5 D did not increase injury when used with or after insecticides; in fact, lead arsenate caused less injury with these materials than when used alone or with some other fungicides.

In tailoring the molecular structure of these new fungicides to meet disease control specifications, attention has been devoted to lowering the interfacial tension of the spray solution itself, so increasing its ability to cover the infection courts and to wet the pathogen. This provision for improved coverage also avoids the drying of arsenicals in heavy splotches of residue.

Richards (B. L.). **Photosynthetic activity affected by fungicides and scab.**—*Fm Res.*, x, 2, pp. 7, 9, 1 fig., 1944.

Experimental evidence obtained by the author under greenhouse conditions in New York showed that scab [*Venturia inaequalis*] infection materially decreased the photosynthesis of apple leaf tissue. Decrease became measurable in eight to ten days, soon after the lesions appeared. By the end of the second week after inoculation the photosynthetic activity of scabbed, living tissue averaged 30 to 40 per cent. of that of healthy tissue, while in the fourth week the figure was 2 or 3 per cent. On the other hand, during the seven weeks after inoculation, the reduction was seldom, if ever, greater than the percentage area of the leaf covered by the scab lesions.

In a further test scabbed and comparable healthy leaf areas were sprayed with 1 to 50 lime-sulphur solution and flotation sulphur paste, 10 lb. per 100 gals. The applications were confined to the upper leaf surface where the lesions were situated, and the experiments were conducted at 75° F. and 50 per cent. R.H. Lime-sulphur on healthy leaves (upper surface only) and flotation sulphur on both healthy and diseased leaves produced no measurable change in photosynthesis during the two days that followed treatment. When, however, diseased leaves, having 17 to 78 per cent. of their area covered by scab lesions, were sprayed with lime-sulphur, their photosynthetic activity was reduced on an average 29 per cent. below that of the two-day period before treatment. These results show that rupture of the leaf cuticle by the fungus seriously increases the susceptibility of apple leaves to spray injury when a caustic material like lime-sulphur is used.

Southwick (L.) & Shaw (J. K.). **Some results in correcting magnesium deficiency in Apple orchards.**—*Proc. Amer. Soc. hort. Sci.*, xliv, pp. 8–14, 1944.

From this progress report on the results of some treatments designed to rectify or mitigate the effects of magnesium deficiency in Massachusetts apple orchards [*R.A.M.*, xxiii, p. 442] it appears that in 1943 four early-season (13th and 25th May, 4th and 16th June) spray applications of 2 per cent. magnesium sulphate on five-year-old trees of 20 varieties on several East Malling root stocks gave commercial control of foliar scorch. Soil applications in the late summer of 1942 of magnesium sulphate, magnesium oxide, and calcined kieserite, all at the rate of 5 lb. per tree, benefited young mulched trees in the following season, but older bearing ones in a commercial orchard failed to respond to the magnesium sulphate and kieserite treatments; magnesium limestone proved ineffectual alone but contributed to the reduction of foliar scorch in combination with magnesium sulphate (25 : 10). On the basis of the results obtained to date, magnesium spray applications are recom-

mended, as they benefit the trees the current season and, if added to regular sprays, entail practically no expense.

Montgomery (H. B. S.) & Moore (M. H.). **The control of bacterial canker and leaf-spot in Sweet Cherry.**—*J. Pomol.*, xxi, 1–4, pp. 155–163, 1 pl., 1945.

Four seasons' spray treatment against bacterial canker (*Pseudomonas morsprunorum*) [*R.A.M.*, xviii, p. 461] of the very susceptible Bigarreau de Schrecken sweet cherry variety, severely affected when the treatment was begun, successfully restored the trees to a sound commercial condition. The applications given consisted of Bordeaux mixture (10–15–100) in the second half of October, just before leaf-fall, and another at a concentration of 6–9–100 in April, just before the blossoms opened. Each gave partial control, while the two in sequence almost eliminated infection by the end of the period. Success is not to be looked for after only one season's treatment: both sprays must be used at the correct time over a period of several seasons.

High autumn rainfall appeared to favour canker the following year, and incidence was also affected by rootstock.

Kenworthy (A. L.). **Injury to Williams Apples resulting from fumigation with methyl bromide.**—*Proc. Amer. Soc. hort. Sci.*, xlv, pp. 141–145, 3 figs., 1944.

In experiments on the effects of methyl bromide fumigation on apples [*R.A.M.*, xxiv, p. 107], the treated Williams showed after nine days 86 and 98 per cent. external and internal injury, respectively, though the unfumigated fruits were uninjured. The surface injury took the form of 'scald', light brown spots $\frac{1}{8}$ to $\frac{3}{4}$ in. in diameter occurring at any point and often coalescing until they covered the entire fruit. The lesions were somewhat depressed, and the brown tissue extended slightly below the skin. The initial internal injury appeared as a brown discoloration of the outer edge of the carpel wall, the entire inner surface of the carpel wall often being brown. In the advanced form of internal injury two types of brown discoloration were observed. The more prevalent developed in the flesh near the outer edge of the carpel wall. The affected area gradually surrounded the core and inner cortex with a clear line of demarcation. Some fruits were completely brown. The less prevalent type developed uniformly from the skin inwards, often invading the entire fruit.

Goodall (D. W.). **Studies in the diagnosis of mineral deficiency. II. A comparison of the mineral content of scorched and healthy leaves from the same Apple tree. III. The mineral composition of different types of leaf on Apple trees in early summer.**—*J. Pomol.*, xxi, 1–4, pp. 90–102, 103–107, 1945.

Spectrographic analyses of leaves of apple trees with deficiency symptoms showed that scorch symptoms were related to a low concentration of either magnesium or potassium in the foliage. A comparison of 21-year-old Egremont Russet trees with others of the same variety recently top-worked on to Bascombe's Mystery showed that the foliage of the former contained more magnesium but much less potassium than that of the latter, which suggests that the trunk can supply much more potassium than magnesium to the young leaves, relatively to their requirements of the two elements.

In slightly scorched leaves the concentration of mineral elements did not differ significantly from that in healthy leaves, except that magnesium was always lower in scorched than in healthy leaves of trees deficient in magnesium. In badly scorched leaves there was also less manganese than in healthy leaves of the same tree.

Between July and October the calcium content of the leaves increased, while magnesium decreased in trees with magnesium deficiency, but increased in others. The concentration of calcium, iron, magnesium, and sodium was higher in the petiole and midrib than in the lamina, while that of manganese was lower. High

iron or manganese in the petiole, due to uncontrolled factors, was associated with a low content in the lamina, and vice versa.

As regards deficiency diagnosis by plant analysis, severely scorched leaves should be avoided, but slight scorch is no drawback, and may facilitate the diagnosis of magnesium deficiency, sampling for which is best done late in the season. Spur leaves are better than shoot leaves for the diagnosis of potassium deficiency.

In the third contribution of this series spectrographic analysis revealed no evidence for selecting one type of leaf rather than another for diagnosing mineral deficiencies, but the results demonstrated the importance of basing comparisons between trees in this respect only on leaves of the same morphological type.

Rhoads (A. S.). **Virus and virus-like diseases of Sweet Cherry in Utah, and notes on some conditions affecting various fruit crops.**—*Plant Dis. Reptr*, xxix, 1, pp. 6–19, 1945. [Mimeographed.]

Detailed notes are given on virus and virus-like diseases of sweet cherries in Utah, as well as on a number of other conditions affecting fruit locally. In northern Utah sweet cherries are attacked by rusty mottle [*R.A.M.*, xxiii, pp. 391. 392], wilt (perhaps due to the western X virus but not yet diagnosed with certainty), rasp leaf [ibid., xxii, pp. 421, 488], chlorotic spotting, crinkle [ibid., xix, p. 693; xx, p. 6], and deep suture [ibid., xxiii, pp. 391, 392]. Powdery mildew (*Podosphaera oxyacanthae*) occurs on sweet and sour cherries, but does not seem to be important.

In Washington County sweet cherries were affected by an apparently new virus disease [which is unnamed]. The condition starts as a series of one to several or many irregularly rounded, greenish-yellow, chlorotic spots at various points, occasionally marginal, on the leaves. When scattered they generally range from $\frac{1}{4}$ to $\frac{1}{2}$ in. in diameter. If numerous they may become confluent, involving sometimes the entire leaf. When the spots are large and scattered, a brownish border surrounds each one, while a small, brown, necrotic area generally occurs at the centre. Affected leaves turn yellow and fall prematurely. In some instances (apparently moderately early stages) one side or some limbs on the crown show conspicuous leaf symptoms, while the foliage on the remaining limbs remains healthy. In advanced cases the disease develops uniformly throughout the crown. By the time the symptoms appear on the foliage throughout a large part of the crown there is considerable defoliation and the limbs most severely affected begin to die back from the ends. The disease is ultimately fatal to the tree.

Both crinkle and deep suture were widespread in Washington County. An abnormal type of foliage referred to as 'incised leaf' was occasionally present. It appears to be related to crinkle. Affected leaves are smaller than normal ones and show irregular, often deeply incised lobes along the margin. Sometimes an abnormal forking of the lateral veins is present. 'Lace leaf', presumed to be due to a virus, was noted on one tree.

Other diseases dealt with include chlorosis of woody plants, associated with iron deficiency, a chlorotic leaf spot of Italian prunes, and a virus-like condition of raspberries, in which the leaves become small, yellow, and curved, the fruit aborts and dries up, and the canes gradually die.

Wilson (E. E.) & Stout (G. L.). **A bud failure disorder in Almond trees.**—*Bull. Dep. Agric. Calif.*, xxxiii, 1, pp. 60–64, 2 figs., 1944.

'Bud failure' of almonds, otherwise known as 'bud shattering', 'crazy top', 'mule tail', or 'witches' broom' has been prevalent for some years in California, especially in the north-central part of the State, affecting chiefly the Nonpareil and Peerless varieties. The outstanding symptom of the disorder is the failure of some or all the buds on a twig to survive and develop into new growth. Shoots arising from the persisting buds on a partially involved twig appear normal during their first season,

but in the following year they also produce many abortive buds. The same process is repeated from year to year. Limbs on the diseased trees tend to be abnormally slender, with long, bare spaces due to the absence of many lateral buds which would ordinarily provide leaves, spurs, or branches. In case of the death of a terminal bud or shoot, limb elongation proceeds from other buds. The shoots produced by the latter, however, sometimes form acute angles with the twigs from which they develop, and repetition of this procedure results in a crooked limb. Blossoms on the affected trees are apparently normal, but owing to their paucity the total nut harvest is much reduced in comparison with that of healthy trees. Spread of the condition from one part of a tree to another has not been observed in the few cases of partial failure so far investigated, while conversely, diseased branches or trees have not been known to recover. No conclusive evidence is forthcoming for the passage of the disease from tree to tree in the orchard. Further grafting experiments are required to determine the possibility of developing a normal new crown by top-working with scions of the same variety. Hitherto no case of an entire tree dying directly from bud failure has been recorded. Inoculation experiments, which have not yet yielded conclusive results, are in progress to test the theory of virus causation of the failure. If bud variation should be responsible, it must be present in more varieties than one.

Bain (H. F.) & Demaree (J. B.). **Red stele root disease of Strawberry caused by Phytophthora fragariae.**—*J. agric. Res.*, lxx, 1, pp. 11–30, 6 figs., 1945.

The root disease of strawberries variously known as red core root, and black, red, or brown stele root disease (*Phytophthora fragariae*) [*R.A.M.*, xxiii, p. 136; xxiv, p. 156] has been intensively studied by the authors in California. The disease has also been found in Arkansas, Connecticut, Delaware, Illinois, Indiana, Kentucky, Maryland, Massachusetts, Michigan, New Jersey, New York, Ohio, Oregon, Pennsylvania, Tennessee, Virginia, Washington, and Wisconsin. The symptoms [which are described] are those of physiological drought and starvation of the aerial parts brought about by the progressive destruction of the root system. Diagnosis of light infection under dry conditions is rather difficult in the absence of the characteristic oospores usually present in the central cylinder. The pathogen is intermediate between most species of *Phytophthora*, which grow readily on a wide variety of media, and those capable of only slow growth on a restricted range. A favourable medium is Lima bean agar, whereas on malt extract agar the fungus made no growth. The low values of 18° to 22° C. for its optimum growth and 25° for a marked decline mark it off from most species. Growth on oatmeal agar at 22° was most vigorous when the value of the P_H was between 6·0 and 7·2. The biciliate, ellipsoidal zoospores, about 10 to 12 μ in diameter, are like others in the genus. The sexual stage has up to now only been definitely observed within the stele of the host and not in cultures. The oospores are large, having a mean maximum diameter of 33·5 μ. If the size of the spore were a diagnostic character, this would show a relation to *P. megasperma*, which has paragynous antheridia, and *P. erythroseptica*, belonging to the amphigynous group. Since the sexual stage is so difficult to observe in the host and is, as yet, unknown elsewhere, it is uncertain which position the antheridium occupies in *P. fragariae*; the fungus differs from *P. megasperma* in its slower rate of growth. Mating different isolates of the fungus gave no evidence of heterothallism, and the unmated strains, when inoculated separately into the roots of growing strawberry plants, invariably produced oospores. Germination of the oospore has not been fully observed. There is no reliable method of germinating these organs; it is difficult, if not impossible, for them to be produced in the absence of the host plant, and the disease has been known to recur in pots that have had diseased plants in them the previous year even when during the summer they have been exposed to 100° F. and so would not contain mycelium. A short test by

the authors has shown that the soil carried the infection for 18 months. In spite of much effort, no suitable treatment of lightly infected plants with fungicides or hot water has been found to give useful results. Inoculation of roots, leaves, and fruits of plants known to be hosts of other *Phytophthora* spp. indicates that *Fragaria* is the only genus susceptible to *P. fragariae*, the following species being highly susceptible: *F. moschata* Duch., *F. virginiania* Duch., *F. vesca* L., and two of three strains of *F. chiloënsis* (L.) Duch. The third strain of the last-mentioned was not infected when tested.

The authors have found the commercial variety Aberdeen highly resistant to direct zoospore inoculation, and also Nos. 127389 and 127392 of the Division of Plant Exploration and Introduction. Test inoculations of susceptible *Fragaria* plants with various non-papillate species of *Phytophthora* were without success. The practicable methods of controlling the disease, therefore, are growing resistant varieties, keeping fields free of strawberries for at least three or four years after the soil has become contaminated, and preventing the introduction of the disease into non-contaminated soil.

Bawden (F. C.). & Kleczkowski (A.). **Protein precipitation and virus inactivation by extracts of Strawberry plants.**—*J. Pomol.*, xxi, 1–4, pp. 2–7, 1945.

Extracts from fully developed leaves of Royal Sovereign strawberry plants, some virus-free, and others affected by crinkle, showed no differences in constitution. When mixed with any antisera or rich normal rabbit serum, both caused an immediate bulky precipitate. The extracts did not alter in appearance when boiled and did not contain any appreciable amount of protein.

The boiled extracts gave a strongly positive test for tannin. From analogy with other viruses, strawberry viruses will probably prove to be proteins. The evidence obtained indicated that when strawberry leaves are minced, large quantities of tannin are released, which precipitate the proteins.

When rubbed over the surface of leaves of tobacco and *Nicotiana glutinosa* the extracts caused scorching and effectively prevented infection with tobacco mosaic virus [*R.A.M.*, xxi, p. 49]. The addition of an equal volume of an aqueous extract of Royal Sovereign strawberry leaves completely inactivated or inhibited a 0·005 per cent. solution of the virus and greatly reduced the infectivity of a 0·05 per cent. solution. That this loss of infectivity was probably produced by tannin in the extract was shown by the still greater inactivation produced by the re-dissolved material extracted from the leaf by acetone.

From these and other experiments it is concluded that failure to transmit strawberry viruses mechanically are just as likely to be due to the properties of the host as to those of the viruses. Almost certainly, all attempts to transmit strawberry viruses by inoculation have been made with fluids containing no virus in an infective state. During maceration of the leaves it would appear that the normal protein, and presumably the viruses, are brought into contact with tannin and perhaps other protein precipitants. These are present in such quantities that after precipitating all the strawberry leaf proteins, aqueous extracts of the 'fibre' contain sufficient to precipitate added proteins; they are also efficient inactivators of mechanically transmitted viruses. Strawberry viruses might not prove transmissible by inoculation, even if they could be extracted from infected plants and freed from inactivating substances; but until this question is settled, failure of mechanical transmission can reasonably be regarded as due to host peculiarities.

Parker (E. R.) & Rounds (M. B.). **Avocado tree decline in relation to soil moisture and drainage in certain California soils.**—*Proc. Amer. Soc. hort. Sci.*, xliv, pp. 71–79, 2 figs., 1944.

Investigations during the winter of 1942–3 in the northern part of San Diego

County, California, showed 'decline' of avocado trees [*R.A.M.*, xiv, p. 707; xxiv, p. 275] to be associated with the presence of free water in the soil, the degree of severity of the disorder being further determined by the extent of inundation of the root zones and the duration of the saturated condition. Irrespective of the primary cause of 'decline' in the area under observation, the predisposing factor is evidently the accumulation of free water in the soil, and control measures should therefore be directed towards the avoidance of this process by a rational system of drainage applicable to the environmental features of particular localities.

Symposium on new developments in fungicides.—*Plant Dis. Reptr, Suppl.* 157, pp. 149–166, 1945. [Mimeographed.]

F. L. Howard, in a paper on quaternary ammonium derivatives, states that the examination of the structural formulae of organic compounds indicated by laboratory tests to be strongly fungicidal showed this action to be the property of a certain category of nitrogen-containing compounds. Dosage-response tests of the inhibition of fungus spore germination repeatedly demonstrated that nitrogen-containing compounds in which only three valences were attached to radicals or ions were usually of low or no fungicidal potency. On the other hand, when the molecular configuration allows the nitrogen forming the nucleus, or part of it, to exert five of its valence bonds, a fungus-inhibiting material may be expected to result. Compounds of the latter class have been designated quaternary ammonium derivatives, of which there are at present four generic groups, viz., substituted quaternary ammonium salts, exemplified by zephirin (a complex of phenyl lauryl dimethyl ammonium chloride); phenyl mercuri triethanol ammonium salts, typified by puratized N 5 D (phenyl mercuri triethanol ammonium lactate) [*R.A.M.*, xxiv, p. 139]; 6-membered heterocyclic nitrogen ring compounds, represented by isothan Q15 (lauryl isoquinolinium bromide) [loc. cit.]; and combined 6- and 5-membered heterocyclic nitrogen ring compounds, including cationic nicotinium salts.

J. W. Heuberger presents an account of dithiocarbamic acid derivatives as fungicides and insecticides.

J. G. Horsfall outlines some methods of assaying synergism [ibid., xxiii, p. 264] and antagonism, which are 'generic expressions to cover the effects of poisons or other ingredients acting jointly', and gives illustrations from plant pathology of additive and potentiated synergism and subtractive and potentiated antagonism. An example of additive synergism is the use of cottonseed or other oil to improve the tenacity of fixed coppers. A case of subtractive antagonism is provided by the reduction in toxicity of copper or mercury by calcium and magnesium salts. The scope of the discussion of potentiated synergism and antagonism is limited by ignorance of the mechanism of these processes. However, an example of apparent potentiated synergism is afforded by the enhancement of the potency of the toxic metallic oxides by the admixture of sulphur. No clear-cut case of potentiated antagonism can yet be cited from the relevant literature.

Tisdale (W. H.). **Insecticides and fungicides.**—*Canad. Chem. Process Industr.*, xxix, 2, pp. 73–77, 4 figs., 1945.

Some interesting new applications of chemical research to the improvement of insecticides and fungicides are surveyed. Most of these advances have been noticed from time to time in this *Review*, but mention may be made of the function of finely divided earths, ground peat, wood or bark flours, nut-shell flour, and charcoal products in the conditioning of plant-protectives for use as dusts and dispersible powders; the development of high-velocity, low-volume machines enabling dusts to be driven over trees more than 50 ft. high, and of low-velocity, large-volume machines, the so-called 'fishtail dusters', which apply dense fogs of dust,

sufficient to blanket good-sized fruit trees; and the treatment of wide strips of low-growing, closely planted crops with motorized ground machines.

Fleck (E. E.) & Haller (H. L.). **Compatibility of DDT with insecticides, fungicides, and fertilizers.**—*Industr. Engng. Chem.*, xxxvii, 4, pp. 403–405, 1945.

Commercial lime-sulphur and 2, 3-dichloro-1, 4-naphthoquinone exerted no catalytic action on the widely used insecticide DDT [*R.A.M.*, xxiv, p. 198]. With mixtures of DDT and ferric dimethyl dithiocarbamate 0·05 mole hydrochloric acid was evolved, the corresponding figures for Bordeaux mixture and sulphur being 0·04 and 0·07, respectively.

Roark (C.). **Incompatibility of insecticides.**—*J. econ. Ent.*, xxxvii, 2, p. 302, 1944.

Previous studies on the 'incompatibility' of insecticides and fungicides are reviewed, with special emphasis on the former. G. P. Gray (*Bett. Fruit*, ix, pp. 9–10, 35–42, 1914) distinguished three types of 'incompatibility', viz., physical, exemplified by water and mineral spray oil, which do not mix or dissolve but remain as two separate layers; chemical, resulting from the mixture of materials with reciprocal chemical reactions; and therapeutic, when two or more substances exerting antagonistic effects on the organism are blended. A study of the several spray-compatibility charts published reveals many differences of opinion, and A. J. Cox (*Spec. Publ. Calif. Dep. Agric.* 184, 1941) proposes the substitution of the terms 'suitable' and 'unsuitable' for 'compatible' and 'incompatible', with specific reference to the pest and host under consideration.

Crosier (W.). **Materials and methods in controlling seed-contaminated micro-organisms.**—*Proc. Ass. Off. Seed. Anal. N. Amer. 1942*, pp. 104–106, 1943. [Lithoprint. Received June, 1945.]

U.S.R. 601 and 604 [*R.A.M.*, xxii, p. 291] satisfactorily control moulds on seed in the laboratory, but are injurious to some seeds. Bromanil (tetrabromobenzoquinone) is far inferior to spergon (tetrachlorobenzoquinone), the failure of this dust as a fungicide being due to its insolubility in water. Spergon is excellent against damping-off and is easily adapted to clay, celite, talc, gypsum, or flour. Thiosan is an excellent protectant, and may be applied safely to any seed. Du Bay 1228 E [loc. cit.] reduces moulds on large seeds. Ethyl mercury tartrate, 154–6 B, and fermate all appear to possess laboratory usefulness.

Watson (R. D.). **Ozone as a fungicide.**—*Abstr. Thes. Cornell Univ. 1942*, pp. 396–399, 1943.

In the author's studies on ozone as a fungicide [cf. *R.A.M.*, xxiii, p. 67] this gas inhibited spore germination and caused plasmylosis in spores. At one part per million it did not completely prevent mould growth on the surface of agar in paper-covered plates, but it suppressed all aerial mould growth. The mycelial growth was under the protective surface of a water film on the agar, and with continuous ozone treatment sporulation was prevented. Mycelia and spores treated with ozone collapsed and turned brown, coloured spores becoming bleached. [*Bacterium*] *coli* was much more susceptible to ozone than the fungi tested. The spores of *Macrosporium* [*Stemphylium*] *sarciniforme* were the most, and those of *Penicillium expansum* the least, resistant.

The effect of the hydrogen-ion concentration of the medium on the toxicity of ozone to *Sclerotinia fructicola* spores was studied. The untreated spores germinated well over a P_H range of 4·3 to 7·95. Germination was about 8 per cent. less at P_H 3·75 than at P_H 4·3 to 7·95. In the plates exposed to ozone germination decreased as the hydrogen-ion concentration increased, indicating that increased acidity increased the toxic effects of the ozone. There were small differences in

germination between P_H 7·95 and 6·15 and a rather greater reduction between 6·15 and 4·3. All the spores were killed at 3·75. The relation between the killing power of ozone and P_H is not clear, but the increased toxicity of ozone as the medium becomes acid is an important factor to consider when experimental results are being interpreted. In tests with a combination of oxides of nitrogen and ozone, oxides of nitrogen had no direct effect on ozone toxicity, indicating that ozone was the toxic agent in ozonized air.

Porter (R. H.). **Testing the quality of seeds for farm and garden.**—*Res. Bull. Iowa agric. Exp. Sta.* 334, 91 pp., 44 figs., 1944.

In this description of methods of seed-testing it is pointed out that it is necessary to examine the sample for the presence of organisms associated with the seed, for seed lots of high purity and germination, if contaminated with pathogens, may be responsible for serious losses in the current and ensuing years. A simple and rapid test is shaking or centrifuging the seeds with sterile water, after which the water is examined for spores. It is possible to measure spore load (e.g., of cereal smuts) by the haemocytometer. If seeds are spread on sterile agar or moist blotters it is usually possible to determine the presence of certain specific organisms. This would be applicable to blight on peas [*Ascochyta pisi*, *A. pinodella*, and *Mycosphaerella pinodes*] or wilt-producing organisms on cabbage [including *Fusarium conglutinans*]. Seeds planted in autoclaved soil and maintained under suitable conditions afford evidence on growing of infection, for example, by [*F. bulbigenum* var. *lycopersici*] on tomato. In the case of virus diseases the plant is grown till it shows the presence or absence of the symptoms. A list is given of the organisms and pathogens associated with a large number of cultivated plants.

Lovelock (J. E.). **Wax pencils for writing on cold, wet glass-ware.**—*Nature, Lond.*, clv, 3941, p. 581, 1945.

The author shows that an addition of 5 to 10 per cent. of a detergent, preferably cationic, to the wax and pigment mixture of commercial wax pencils, will overcome the difficulty experienced when using such pencils on glass which is cold or covered with a film of moisture. The following formula is one of many whereby wax pencils can be made in the laboratory without special skill: hard paraffin wax (m.p. 65° C.), 100 gm.; beeswax, 20 gm.; vaseline, 20 gm.; C.T.A.B. (cetyl-trimethylammonium bromide) 10 gm.; fat-soluble dyestuff (for example, Sudan III), 0·5 to 1 gm. The mixture is heated and stirred in a water bath until the waxes melt and the dye and detergent dissolve; 20 gm. titanium oxide or other white pigment is then stirred in. The mixture is cast into sticks 6 in. long by $\frac{1}{8}$ in. in diameter, and wrapped in paper.

Lewis (R. W.) & Lucas (E. H.). **Apparatus for growing micro-organisms on a flowing medium.**—*Science*, N.S. ci, 2623, pp. 364–365, 1 fig., 1945.

An apparatus for growing micro-organisms on cellulose tubing is described and figured. It consists of 50 ft. of $\frac{1}{4}$ in. cellulose tubing wound in a coil on supports and suspended in a pyrex glass cylinder. The ends of the tubing are attached to glass tubes which pass out through rubber corks in an aluminium cover. This part is covered with a cloth hood, the outlets are wrapped, and sterilized in an autoclave. A 3-gal. bottle of sterile medium is attached by a rubber tube to the cellulose tube inlet and is supported so that the medium flows into the latter. The outside of the tubing is sprayed with a spore suspension by a special atomizer inserted through an opening in the aluminium cover.

Two or three days after inoculation with *Penicillium notatum* the tubing was covered with mycelium. As a rule the medium was changed daily. On the fourth or fifth day the fungus was covered with spores. When growth was established, the medium was allowed to drop from the outlet tube. On the sixth to eighth day

penicillin was detected in the run-off medium. In a few days the penicillin titre equalled or surpassed that of a flask culture. It is considered that this apparatus would become a useful laboratory tool if better cellulose tubing, not liable to develop leaks, can be obtained.

Preservation of fabrics.—*Mon. Sci. News, 1945*, 5, 1945. [Issued by the British Council, 3 Hanover Street, London.]

After giving brief notes on a number of chemicals used to preserve textiles from fungal and bacterial deterioration, the author states that if cellulose is partly acetylated, its natural properties can be left almost unimpaired or even improved, and its life will be indefinitely prolonged, because it becomes immune from attack. Some of the newer synthetic fibres are also highly resistant to microbial action, nylon, for example, being apparently immune.

Greathouse (G. A.) & Ames (L. M.). **Fabric deterioration by thirteen described and three new species of Chaetomium.**—*Mycologia*, xxxvii, 1, pp. 138–155, 7 figs., 1945.

After pointing out that the rapid deterioration of military fabrics in many tropical and subtropical areas has drawn attention to cellulose-decomposing fungi, among them species of *Chaetomium* [*R.A.M.*, xxiii, p. 266], the authors present evidence of the ability of 16 species of this genus to decompose cotton fabric under varied conditions. Arranged in descending order of deteriorating capacity, the species are *C. globosum*, *C. caprinum*, *C. cancroideum*, *C. dolichotrichum* n.sp., *C. funicolum*, *C. elatum*, *C. contortum*, *C. bostrychodes*, *C. cochliodes*, *C. murarum*, *C. ochraceum*, *C. aterrimum*, *C. aureum*, *C. pachypodioides* n.sp., *C. convolutum*, and *C. microcephalum* n.sp.

When the ability of these species to decompose cellulose fabric in the presence of a standard nutrient salt medium in which the nitrogen was obtained from four different sources was studied, it was found that they fell into seven groups based on their ability to utilize the cotton fabric in the presence of different nitrogen sources. Group I included *C. globosum* and *C. caprinum*, very active cellulose-decomposers that produce slightly greater losses in breaking strength on the nitrogen source sodium nitrate, that ranges on the alkaline side of neutrality after utilization of the nitrate radical by the fungus. Group II was represented by *C. cancroideum*, an active cellulose-decomposer apparently most active on the neutral to slightly acid medium, ammonium nitrate. Group III contained *C. dolichotrichum*, *C. funicolum*, *C. elatum*, and *C. contortum*, active cellulose-destroyers thriving especially well on the more acid nitrogen sources, ammonium nitrate, ammonium sulphate, and ammonium dihydrogen phosphate. Group IV was characterized by species active to moderately active in destroying cellulose and with no marked preference for nitrogen sources. Group V was confined in its preference of nitrogen source to ammonium sulphate and ammonium dihydrogen phosphate, on which it produced moderate losses in breaking strength. Group VI, represented by *C. convolutum*, was relatively inactive. Group VII (*C. microcephalum*) seemed to be restricted in its ability to decompose cellulose to the ammonium nitrate medium. The criterion used for physiological differentiation between the species was the percentage loss in breaking strength of the fabric after seven days' incubation of each isolate.

It is concluded that the organism used in testing fabrics for resistance to mildew should be capable of rapid destruction, stable in its cultural and cellulose-destroying characters, of established response to specific factors, i.e., P_H, temperature, fabric preservative, etc., and of known distribution and occurrence in nature. *C. globosum* and several other species of *Chaetomium* meet most of these requirements [cf. ibid., xxiv, p. 159 *et passim*].

Dean (J. D.), Strickland (W. B.), & Berard (W. N.). **The soil burial test for rot-proofed Cotton fabrics.**—*Amer. Dyest. Reptr*, xxxiv, 10, pp. 195–201, 4 figs., 2 graphs, 1945.

A preliminary study conducted at the Southern Regional Research Laboratory, New Orleans, on the soil-burial method of testing rot-proofed cotton fabrics has already been reported [*R.A.M.*, xxiv, p. 158]. In the writer's experiments with copper naphthenate-treated osnaburg, a well-protected sample weighing 6 to 8 oz. per sq. yd. was found to withstand three weeks' burial in fresh soil before undergoing significant deterioration, and for a satisfactory determination of resistance it is preferable to extend the trial period until strength loss amounts to roughly 80 per cent. of the original (average of six weeks). The soil-burial method must thus be definitely placed in the long-range category of evaluation tests, and as yet no high degree of scientific exactitude can be claimed for it. From the practical standpoint, however, it has given reasonably dependable results, the available data indicating that treatments consistently showing high resistance numbers in soil-burial tests make the best records in service performance.

Mould-resistant leathers for use in tropical conditions.—Reprinted from *Mon. Dig. Brit. Leath. Mfrs' Res. Ass.*, 5 pp., February, 1945.

In the past the British Leather Manufacturers' Research Association has recommended the use of the following fungicides (in descending order of preference) against moulds on finished leather [*R.A.M.*, xxiii, p. 401]: para-nitrophenol, β-naphthol, cresylic acid (mixed ortho-, meta-, and para-cresols sold commercially as 'anti-gallic'), and sodium tri-chlorphenate (2–4–5 isomer). American and Australian workers have recommended, in addition, salicyl anilide (shirlan), penta-chlorphenol or its sodium salt (santobrite), and para-chlormeta-xylenol. Organic mercurials are effective, but are apt to cause skin irritation, and highly chlorinated organic compounds, such as penta-chlorphenol, would probably behave similarly.

The fungicides put forward by the Association for present consideration are para-nitrophenol, β-naphthol, and anti-gallic. The first-named is the most widely recommended fungicide for leather, while β-naphthol comes next in general usefulness. Anti-gallic is a good fungicide on vegetable-tanned leather. It is rather less efficient than β-naphthol, but being sold in liquid form, is easy to apply in tan liquors. Shirlan was not efficient in laboratory tests on vegetable-tanned leather, but in field tests in West Africa it gave satisfactory results, when used in higher concentration and applied in grease.

If the treatment is applied in the late tan liquors, 1 part by weight of para-nitrophenol in 1,000 parts tan liquor (i.e., 1 lb. per 100 gals.) is sufficient under English climatic conditions to prevent either the liquor or the leather tanned in it from developing mould. If the leather is to be used in the tropics, a higher concentration is desirable. With β-naphthol, 1 part by weight in 500 parts tan liquor is recommended for leather to be used in this country, with higher concentrations for use in the tropics.

The method of drumming-in para-nitrophenol has also been successfully used in practice with vegetable-tanned bellies in this country. The concentrated stock solution in methylated spirit is added to the drum liquor to give approximately 0·1 per cent. by weight of the fungicide on the dry leather; for tropical conditions, double this amount should be used.

If incorporated in grease, more fungicide is required. Recent field tests in the tropics indicate that the amount of para-nitrophenol or β-naphthol so added should give a final concentration of 0·3 per cent. on vegetable-tanned leather. This figure applies to leather where the full load of fungicide is added to the grease. If added partly from an aqueous medium and partly in the grease, 0·2 per cent. on the weight

of the vegetable-tanned leather will suffice. Chrome or semi-chrome leather, where grease application is recommended, should contain 0·12 per cent. fungicide. The paper concludes with notes on special cases and recommended methods.

Testing the tropical mould-proofness of leather.—1 p., pre-print from *Mon. Dig. Brit. Leath. Mfrs' Res. Ass.*, April, 1945.

The testing conditions and standards adopted by the British Leather Manufacturers Research Association are as follows:—

Leather treated against moulds [cf. *R.A.M.*, xxiii, p. 400; xxiv, p. 160] should remain virtually free from attack for four weeks if maintained at approximately 30° C. and 100 per cent. relative humidity. The temperature should not rise above 37° or fall below 25°. The apparatus used is generally kept in the dark. As a rule it is unnecessary to inoculate the test pieces, as mould spores are present in the atmosphere and also in most leathers. Samples showing mould growth on the cut edges and those with only one or two small colonies at the close of the test period may be regarded as satisfactorily proofed.

Two forms of apparatus are used for testing. The first is a stoppered glass jar, at the bottom of which cotton wool is placed, saturated with hot water. A piece of leather measuring about 2 by 4 in. is suspended over the cotton wool and the jar closed, and kept under the temperature conditions described above for a period not exceeding four weeks, the lid being removed from time to time to make necessary observations and replaced as quickly as possible.

The second form of apparatus consists of a box resembling that described in *Mon. Dig.*, p. 61, March, 1945, but without the hand-holes, in which test pieces of leather are placed on shelves. Water is placed in a dish at the bottom. The same temperature conditions are observed, and water is added to replace that lost by evaporation.

Magrou (J.). **Des Orchidées à la Pomme de Terre. Essai sur la symbiose.** [From the Orchidaceae to the Potato. A sketch of symbiosis.]—203 pp., Paris, Gallimard (Collection 'L'Avenir de la Science', No. 18), 1943. Fr. 38. [Review by E. Roubaud in *Bull. Inst. Pasteur*, xlii, 5–6, pp. 129–131, 1944.]

N. Bernard's studies on the function of mycorrhiza in tuberization among the Orchidaceae and wild Solanaceae form the starting-point of this stimulating survey of the progress to date in the investigation of endophytic invasion of the root system of the cultivated potato, which has been carried on by the author and his collaborators in France. The horticultural and agricultural applications of the discovery that asymbiotic tuberization, both in orchids [*R.A.M.*, xxiv, pp. 200,] and potatoes [ibid., xxiv, p. 242], can be effected by adjustment of the osmotic concentration of the medium through the addition of glycerine or sugar, are discussed in relation to potato cultivation. In nature the formation of tubers in cultivated potatoes lacking mycorrhiza is attributed to the action of the osmotic pressure of the medium surrounding the roots. Two methods are recommended for the production of sound tubers free from degeneration—either planting in mountain soils containing mycorrhiza or the judicious combination of asymbiotic and symbiotic cultures.

Brian (P. W.), Hemming (H. G.), & McGowan (J. C.). **Origin of a toxicity to mycorrhiza in Wareham heath soil.**—*Nature, Lond.*, clv, 3943, pp. 637–638, 1945.

The authors, referring to the growth failure of conifers at Wareham, Dorset (attributed by Rayner [*R.A.M.*, xxi, p. 298] and Neilson Jones [ibid., xxiv, p. 111] to a toxicity to the mycorrhizal fungi normally associated with those trees), and to Neilson Jones's suggestion that it may be due to the production of hydrogen sulphide by aerobic sulphate-reducing bacteria, claim on their part to show that

toxicity is due, at least partly, to the production of fungistatic organic substances by certain *Penicillium* spp. characteristic of the Wareham soil.

Organisms such as *Mucor* spp., *Trichoderma viride*, *P. chrysogenum*, and *Fusarium* spp., which are abundant in meadow or arable soils, were found to be virtually absent from Wareham soils. The soil flora was almost restricted to species of *Penicillium*, of which *P. janczewskii* was the most abundant.

Cultures of these moulds were grown on liquid media and assayed periodically for anti-bacterial and fungistatic activity. Isolates of the *P. jenseni* and *P. nigricans-janczewskii* series produced filtrates antibiotic to *Botrytis allii*. Gliotoxin, extracted from *P. jenseni* and *T. viride*, was found to be highly toxic to mycorrhizal fungi: the researches of Newman and Norman [ibid., xxii, p. 371] are cited as evidence that low microbiological activity in surface subsoils is due to the accumulation of antibiotic metabolic products of certain soil organisms. In these circumstances it is considered plausible to attribute the toxicity of Wareham soil to mycorrhizal fungi to gliotoxin and other antibiotic substances produced by the *Penicillium* spp. dominating its mould flora.

Castellanos (A.). **Los tuberculos radiculares del Aliso ('Alnus jorullensis' H.B.K. var. 'spachii' Regel).** [The root tubercles of the Alder ('*Alnus jorullensis*' H.B.K. var. '*spachii*' Regel).]—*Lilloa Rev. Bot. Tucumán*, x, 2, pp. 413–416, 2 figs., 1944. [English summary.]

The tubercles which occur on the roots of alders (*Alnus jorullensis* var. *spachii*) in the mountains of Tucumán and Salta (Orán), Argentina [cf. *R.A.M.*, xxi, p. 35; xxii, p. 265] are said to be analogous to the nodules of the Leguminosae. The secondary rootlets develop protuberances resembling galls or abnormalities of parasitic origin, while roots of varying diameter bear on their exterior coralline, chestnut-coloured excrescences composed of innumerable branches which proliferate successively to terminate in club-shaped tips. Microscopic examination of a longitudinal section of the tubercle reveals the finely granular consistency of the cells.

Sansome (Eva R.), Demerec (M.), & Hollaender (A.). **Quantitative irradiation experiments with Neurospora crassa. I. Experiments with X-rays.**—*Amer. J. Bot.*, xxxii, 4, pp. 218–226, 1 graph, 1945.

Exposure of the microconidia of *Neurospora crassa* to X-radiation produced variants which genetic analysis demonstrated to be mutants. The increase in mutation rate with increase in energy followed a straight-line relationship at low dosages and attained 78·5 per cent. at 126,000 roentgens. Increased intensity led to increase in the mutation rate. Phenotypic normal and mutant cultures often showed partial sterility when crossed with a standard wild type, this character being attributed to chromosomal aberration. Analysis of the sterility and mutation rates at different dosages and intensities indicated that there are two types of mutants, of which one is caused by chromosomal aberration.

Hollaender (A.), Sansome (Eva R.), Zimmer (E.), & Demerec (M.). **Quantitative irradiation experiments with Neurospora crassa. II. Ultraviolet irradiation.**—*Amer. J. Bot.*, xxxii, 4, pp. 226–235, 9 figs., 1 graph, 1945.

Continuing their investigations [see preceding abstract], the authors exposed the microconidia of *Neurospora crassa* to ultra-violet irradiation. The most effective wave-length in inducing mutations was 2,650. Genetic analysis showed that 24 of 60 mutants were multiple, and the hypothesis that spores differ in their capacity to give a chromosome rather than a chromatid response to ultra-violet radiation was found insufficient to explain the data, though evidence was obtained that both chromatid and chromosome effects occur. Sterility associated with the mutants was much less frequent than with X-ray-induced mutants. It is suggested that the

ultra-violet effects are localized, whereas the X-ray effects are more diversified, including chromosome breaks and rearrangements.

Roach (W. A.) & Roberts (W. O.). **Further work on plant injection for diagnostic and curative purposes.**—*J. Pomol.*, xxi, 1–4, pp. 108–119, 9 figs., 1945.

In this further account of plant injection studies [*R.A.M.*, xxi, p. 459] the authors describe and figure various improvements made in the appliances used for diagnostic and therapeutic purposes. Notes are given on the results obtained both in Britain and South Africa in the use of injection methods with 25 different kinds of plants, including fruit trees and bushes, forage plants, hops, potatoes, tomatoes, tobacco, and others. An improved method of injecting solids into a tree consists of drilling a small hole through the bark, continuing it at a decreased diameter into the wood, inserting by means of a metal tube and plunger chemical tablets into the wood, and sealing them in with a cork disk, over which the bark soon heals. In this way the tree sustains a minimum of damage.

Weiss (F.). **Viruses and virus diseases and similar maladies of Potatoes, Solanum tuberosum.**—*Plant Dis. Reptr, Suppl.* 155, pp. 82–140, 1945. [Mimeographed.]

This third descriptive list of plant viruses compiled under the auspices of the Committee on Virus Classification and Nomenclature of the American Phytopathological Society is on lines similar to the two preceding lists [*R.A.M.*, xxiv, p. 259], and seeks to solve difficulties presented by the diversity of names applied to potato viruses in different countries and by different investigators. The author offers (1) a statement of the cause of each disease as far as available information permits; (2) the designation of a common name under which information pertaining to each disease is filed in the records and indexes of the American Phytopathological Society; and (3) the listing of names believed to be synonymous or equivalent in the United States and in other countries.

Vasudeva (R. S.) & Lal (T. B.). **Studies on the virus diseases of Potatoes in India, I. Occurrence of Solanum virus 1.**—*Indian J. agric. Sci.*, xiv, 4, pp. 288–295, 2 pl., 1945.

The authors describe and tabulate the properties and effects on differential hosts (White Burley tobacco, *Nicotiana glutinosa*, *N. rustica*, *N. sylvestris*, *Datura stramonium*, *Solanum nodiflorum*, *Capsicum annuum*, and Sutton's Early Market tomato) of a relatively virulent strain of *Solanum* virus 1 [potato virus X], isolated at the Imperial Agricultural Research Institute, New Delhi, from Majestic potatoes originating at Bhowali, United Provinces. The infectivity of the virus is lost at a dilution of 1 in 100,000, and ten minutes' exposure to a temperature of 75° C. suffices to destroy the active principle. The activity of the virus is not impaired by passage through Chamberland filters of grades L_3 and L_5 or by 202 days' storage, and it was still viable, though with diminished virulence, after 234 days. Similarly, drying at room temperature reduced the violence of the virus but did not altogether inactivate it. It succumbed, however, to 12 and 32 hours' exposure to the vapours of absolute alcohol and ether, respectively. On the basis of the symptoms induced on the above-mentioned differential hosts, 12 isolates of potato virus X, including the one under discussion, have been divided into four groups, in which the symptoms produced are (1) generally faint, (2) definite or pronounced, (3) highly pronounced or necrotic, and (4) extremely severe necrosis and even collapse of the leaves, respectively.

Bald (J. G.). **Progress of work with Potato stocks free from virus X (FX Potatoes).**—*J. Coun. sci. industr. Res. Aust.*, xvii, 4, pp. 258–263, 1944.

In 1941 12 clones of Up-to-Date Potatoes free from virus X were divided into seven maturity classes, and after three years the yields roughly confirmed this

classification. From this and other evidence it is clear that there are agronomic differences between the clones of FX Up-to-Date, but it will take years to find the clones most suitable to different regions. It has been found easy to add other clones to these, for when selections are made in the field on a basis of yield, tuber type, and freedom from disease and these selections are multiplied and selected, the most promising tubers from the multiplied stock have been found by inoculation tests to be free from virus X. Two important results have been obtained: first, that FX stocks can be grown on farms for several successive years under commercial conditions without becoming infected; and second, that the actual yields of FX stocks are greater than those from certified seed which is X-infected. The trials show a gain of between 14 and 27 per cent. except in one instance, a trial between FX clones from another district against local infected seed. The amount of FX Up-to-Date seed tubers available for planting next season will probably exceed 50 tons, though much was lost by rot in transit owing to war conditions.

In Tasmania virus A in combination with virus X caused such losses in Silverskin Bismarck that the variety was threatened with virtual extinction. After it had been freed by selection from virus A, two tubers of healthy-looking plants were found to be free from virus X. This Bismarck clone has been multiplied, so that it is hoped there will be sufficient seed for nearly two acres next year, and the appearance of vigour and the yield and quality of the tubers are so good that the Bismarck FX will be included in the scheme.

In Victoria the variety Snowflake is sometimes found to contain a high percentage of diseased and unthrifty plants. Five FX Snowflake have been taken over by the Victoria Department of Agriculture for multiplication. Two promising American varieties are Katahdin and Sebago. Stocks of these received by the Australian Council have been maintained virus-free, but other introductions, especially of the latter variety, have become infected. Certain varieties such as Carman (possibly synonymous with Green Mountain), Brownell, and Delaware have failed in spite of much effort to yield virus-free stocks.

The plan for the distribution of FX stock is not yet fully in operation. Growers will be required to renew their certified FX seed regularly from crops derived from multiplication blocks. These in their turn are obtained from isolation blocks derived from foundation blocks. Of the two varieties so far taken into the FX plan, Bismarck is susceptible to virus A, while Up-to-Date is field-immune. Their reactions towards leaf roll are reversed. Hence, if the isolation crop surrounds the the very valuable foundation crop, the latter is buffered against visits of infective winged aphids from a distance and from aphid-borne infection from the isolation blocks by the differences in susceptibility of the two species. The cost of the foundation and isolation blocks is borne by the Commonwealth Government; they are situated in Tasmania. The tubers are distributed free to the State Departments of Agriculture. Testing for virus X, which at present is performed by inoculation on *Datura stramonium*, is shared by the Tasmanian and Canberra officials.

Bald (J. G.). **Development of differences in yield between FX and virus X-infected Up-to-Date Potatoes.**—*J. Coun. sci. Industr. Res. Aust.*, xvii, 4, pp. 263–273, 1944.

In connexion with yield trials of FX Up-to-Date stocks [see preceding abstract], tests were carried out near Canberra to compare the yield of FX tubers with (1) Tasmanian Up-to-Date, practically uninfected with virus X, (2) certified but X-infected Up-to-Date, and (3) Bismarck (an early variety) certified but X-infected and other varieties. In one test a portion of the crop planted in October, 1943, was lifted when immature, in February, 1944, and another in April. The yield of the tubers lifted at these dates expressed as percentages of the mean yield of FX-Up-to-Date were (1) Tasmanian 99 and 103 per cent., respectively, (2) certified but

infected Up-to-Date, 96 and 83 per cent., respectively, and (3) Bismarck 107 and 63 per cent., respectively. It will be seen that the infected stocks were lower in yield at maturity, but not markedly so when immature. A complication occurs in the case of an early variety as, at a given time, a different leaf area is available for that variety. The leaf areas were measured from time to time, but the yields per leaf area did not point to a different result. A second test using other varieties led to the same result, namely, that the plants from virus X-free tubers produce larger yields than those from infected tubers and that the difference occurs after the completion of growth.

It is at least as probable that this is due to the protein as to the carbohydrate metabolism, for under Australian conditions infection by virus X does not affect outer leaf area up to the time it reaches its maximum or the yield till tuberization is well advanced; thus it does not cause a serious loss in efficiency either of photosynthesis or the translocation of its products. It has, however, been shown to cause reduction in flowering, and flowering makes demands on mobile protein. It is unlikely that flow through the roots is altered by infection, for the ash content of the plant is the same in infected as in non-infected plants. Again, there is an equal percentage of carbon in the dry weight of the tubers, though in old infected plants there is more sugar and starch in the leaves. It is believed that the virus causes the formation of a virus protein instead of the normal chromoprotein (chloroprotein).

Feistritzer (W.). **Möglichkeiten einer systematischen Resistenzzüchtung gegen die Abbaukrankheiten der Kartoffel.** [Possibilities of systematic breeding for resistance to degeneration diseases of the Potato.]—*Kühn-Arch.*, lx, pp. 347–357, 2 diags., 1944.

A tabulated survey is given of several years' investigations on the breeding of potatoes for resistance to 'degeneration' diseases (mostly leaf roll and various types of mosaic) in Germany, the outcome of which is discussed in relation to some contemporary studies on the same project. The following are among the conclusions reached. (1) Trial fields must be situated in such a way as to provide all the viruses with equal opportunities of access to the breeding material. (2) In order to counteract the various elements of uncertainty and irregularity inherent in outdoor trials the breeding material should be subjected, at each stage in the process of selection, to several years' tests, preferably with the repeated introduction of standard varieties for comparison. In this connexion a four-year scheme is propounded and explained. (3) The varying grades of resistance in early sorts cannot be correctly appraised in districts where natural infection is so intense as to involve the entire first-year progeny, and material of this kind should be tested in less severely affected localities. (4) The number of highly resistant offspring of a cross depends on the degree of resistance possessed by the parents. (5) From crosses between two highly resistant varieties of *Solanum tuberosum* progeny may arise with a capacity for resistance surpassing that of the progenitors. (6) The combination of 'high resistance × very good quality' is not unrepeatable, but may be developed by rational crossing and selection. The following combinations are recommended as offering particularly attractive possibilities: (*a*) very good quality and high resistance × high resistance plus medium to good quality, e.g., Flava × Böhm's Mittelfrühe; (*b*) very good quality plus high resistance × moderate to medium resistance plus high quality, e.g., Flava × Sieglinde; and (*c*) very good quality plus moderate to medium resistance × high resistance plus fair quality, e.g., Flämingskost × Böhm's Mittelfrühe.

Skaptason (J. B.). **Studies of the bacterial ring rot disease of Potatoes.**—*Abstr. Thes. Cornell Univ. 1942*, pp. 383–385, 1943.

Bacterial ring rot of potatoes (*Corynebacterium sepedonicum*) [*R.A.M.*, xxiv,

pp. 5. 116], first recorded in 1906 from Germany, was found in Canada in 1931. In 1932, it was reported from Maine, and by 1940 it was present in 37 States. It was first observed in New York State in 1939.

Preliminary experiments with a medium developed by Burkholder showed that optimum growth occurred at 23° C. in medium buffered to P_H 6·8. Potato extract was found to be essential for growth in culture. The active factor in the potato extract was not replaceable by nicotinic acid, B-alanine, pantothenic acid, pimelic acid, biotin, or thiamin chloride. It was stable to autoclaving, hydrolysable, and precipitated by acetone, alcohol-ether mixture, alcohol, chloroform, barium hydroxide, and phosphotungstic acid. When a potato sample was ashed, it was ascertained that the ash could replace the potato extract in the nutrition of the organism. Finally, the potato ash in the medium was replaced by a mineral element solution containing magnesium sulphate, ferric ammonium sulphate, manganous sulphate, zinc sulphate, and calcium nitrate.

Affected tubers examined under ultra-violet light showed a greenish fluorescence in the vascular area, which was found to be due to the presence of riboflavin. Assays demonstrated that there was at least six times as much of this vitamin in diseased as in healthy tissue. It was also ascertained that the organism synthesizes riboflavin in culture.

From studies on the life-history of the pathogen it was concluded that plant-to-plant spread in the field is not an important mode of dissemination, but that spread occurs almost entirely during seed-cutting and planting. Persistence of the organism in a field through the survival of volunteer plants is not important in the perpetuation of the disease.

Nattrass (R. M.). **Spraying small areas against Potato blight.**—*E. Afr. agric. J.*, x, 4, p. 238, 1945.

The writer draws attention to the fact that with the aid of an ordinary A.R.P. stirrup-pump an area of 500 to 600 sq. yds. of potatoes can be sprayed against blight [*Phytophthora infestans*], using the standard 18-ft. hose, from one position of the bucket. A better cover is obtained if the plants are sprayed while wet with dew, using a watering-can [*R.A.M.*, xxi, p. 470] or the pump and keeping the nozzle moving rapidly over the crop. The dew serves to spread the fungicide and when dry, the deposit is evenly distributed. As the fungicide becomes diluted by the dew, a stronger solution should be used; with Burgundy mixture a concentration of at least 2 per cent. is advised.

Wallace (T.). **The diagnosis of mineral deficiencies in plants by visual symptoms. Supplement. A colour atlas and guide.**—48 pp., 95 pl., London, H.M. Stationery Office, 1944. 5*s*.

This supplement [cf. *R.A.M.*, xxii, p. 406] records symptoms of mineral deficiencies in flax, broad bean, pea, red clover, lucerne, lettuce, radish, leek, celery, pear, plum, and sweet cherry, and additional symptoms for other crops. Nitrogen deficiency is depicted for wheat, flax, and vegetable and fruit crops, and recent occurrences of molybdenum deficiency in pasture plants are recorded. An index of crops in the colour plates of both the main edition and the supplement is included.

Blair (I. D.). **Techniques for soil fungus studies.**—*N.Z.J. Sci. Tech.*, A, xxvi, 5, pp. 258–271, 9 figs., 4 graphs, 1945.

This is an expanded description of the writer's applications of the Rossi-Cholodny glass-slide technique to the examination of *Rhizoctonia* [*Corticium*] *solani* in unsterilized New Zealand field soil [*R.A.M.*, xxii, p. 449].

Asthana (R. P.). & Mahmud (K. A.). **Bacterial leaf spot of Piper betle.**—*Indian J. agric. Sci.*, xiv, 4, pp. 283–288, 2 figs., 1945.

An account is given of a bacterial leaf spot of *Piper betle* which is responsible for heavy annual losses in the Central Provinces and Berar. The causal organism is quite distinct from those of other bacterial diseases of the same host [*R.A.M.*, xxiv, p. 289] and is referred to *Bacterium betle*, originally described by Ragunathan from Ceylon [ibid., vii, p. 741]. The brown to dark brown, yellow-bordered, circular or angular spots, 1 to 5 mm. in diameter under dry conditions, expand to 1 cm. with the advent of wet weather and frequently coalesce into large patches, the centre of which may crack or fall through. The infected leaves become dull, flaccid, and pale, and are finally shed. A gummy bacterial exudate is deposited on the under side of the leaf. Entry to the foliage is effected through the stomata. The disease is prevalent in heavy soils in low-lying, waterlogged gardens, the Kapuri variety being the most susceptible. Satisfactory control on a financially sound basis may be obtained by irrigation of the gardens a week before planting with 4-4-50 Bordeaux mixture (1 gal. per 12 linear ft.) and spraying the vines with the same compound at 2–2–50 every two months, allowing 1 gal. per 75 ft.

Arruda (S. C.) & Franco do Amaral (J.). **Leaf scald of Sugar Cane in Brazil.**—*Phytopathology*, xxxv, 2, pp. 135–137, 1945.

Microscopic examination, cultural studies, and inoculation tests, the results of which are tabulated, are stated to have confirmed the suspected identity of the agent of a sugar-cane disease in Piracicaba, São Paulo, Brazil, characterized by typical leaf-scald symptoms, with *Phytomonas* (*Xanthomonas*) *albilineans*. The disease has been present in the region under observation for several years and has been under investigation since March, 1943.

Dufrénoy (J.). **The occurrence of pyridox (vitamin B6) in Sugar-cane tissues.**—*Proc. La Acad. Sci.*, vii, pp. 13–16, 1942. [Received April, 1945.]

The phenolic substance present in the nodal tissue of certain sugar-cane varieties in Louisiana, e.g., Co. 281, C.P. 28–19, F. 31–962, C.P. 34–21, C.P. 34–54, C.P. 34–79, C.P. 34–84, C.P. 34–86, and C.P. 34-92, is thought to be pyridoxin (vitamin B_6). Margins of red-rot (*Colletotrichum falcatum*) [*Physalospora tucumanensis*] lesions in the sites in question gave a much higher pyridoxin reaction than healthy nodal tissues.

Cross (W. E.). **Informaciones relacionadas con la lucha contra el 'carbón' de la Caña de Azúcar.** [Notifications relating to the campaign against Sugar-Cane 'smut'.]—*Rev. industr. agric. Tucumán*, xxxiv, 4–6, pp. 45–91, 1944.

The information disseminated by the Tucumán (Argentina) Agricultural Experiment Station in its various publications concerning the control of sugar-cane smut [*Ustilago scitaminea*], primarily through the cultivation of immune or resistant varieties [*R.A.M.*, xxiv, p. 73], has been collected and reproduced.

Orjuela Navarrete (J. E.). **Situación patológica de las plantaciones de Caña de Azúcar en las zonas del valle de Cúcuta, Villa del Rosario y regiones aledañas.** [The pathological situation of the Sugar-Cane plantations in the zones of the valley of Cúcuta, Villa del Rosario, and adjoining regions.]—*Rev. Fac. Agron., Medellín*, v, 21, pp. 200–231, 1944.

Previous studies on a destructive root rot of sugar-cane in the Cúcuta Valley, Villa del Rosario, and adjoining regions of Colombia revealed the presence in the plantations of a species of *Rhizoctonia*, though attempts to isolate the fungus were unsuccessful. Material from the Moros district, whence *Thielaviopsis* [*Ceratostomella*] *paradoxa* had already been reported in connexion with the root rot, again

yielded the same fungus in the present investigation. Other organisms associated with the disease included *Diplodia* [*Botryodiplodia*] *theobromae*, *Melanconium* [*Pleocyta*] *sacchari*, *Pythium* spp., *Fusarium* spp., and *Acrostalagmus*.

Contributory factors in the etiology of the root rot are the primitive agricultural methods practised in the affected areas, coupled with excessive irrigation. Nematodes (*Tylenchus* sp.) are another source of injury, some observations on which by F. J. Otoya are included in this paper (pp. 218-223). Control measures should be based, in the first instance, on the rehabilitation of the plantations by appropriate modifications in the present system of cultivation, including the installation of proper drainage. Other necessary reforms include the establishment of a sugar-cane station in Cúcuta to serve as a plant-breeding and seed-certification centre, where 'seed' canes would also be treated, primarily against *C. paradoxa*, by 24 to 36 hours' immersion in a 2 per cent. lime solution, followed by protracted immersion in 4–4–50 Bordeaux mixture.

Chona (B. L.). **Sugarcane mosaic and its control.**— *Indian Frng.* v, 4, pp. 178–181, 1944.

Of the four virus diseases of sugar-cane, mosaic, streak, sereh, and Fiji disease, only the first is commonly found in India. Sereh and Fiji disease are absent, and streak has been observed only on two occasions some years ago on Uba cane at Aligarh [United Provinces], and recently on a solitary clump of an indigenous cane at Pusa [cf. *R.A.M.*, vii, 303; x, p. 360].

In experiments in which plots were planted with setts from diseased and healthy plants, it was frequently observed that the plants in the mosaic plots were not all diseased, some of them appearing quite normal. Leaf juice of these healthy canes (Co. 213, 223, 313, 299, and 419) in no case gave rise to mosaic symptoms when inoculated into young cane, maize, and jowar (sorghum) plants.

Both at Pusa and Delhi, it was found that during May and June, artificial transmission was nearly 100 per cent. successful and the incubation period only seven to ten days, hot weather appearing to favour transmission. The evidence obtained indicated that the virus even in the period most unfavourable for artificial transmission is as viable as it is in May and June.

The thermal death point of mosaic juice of different varieties from different localities ranged from 45° to 65° C. Three distinct strains were distinguished, represented by those on Co. 213 (Pusa), Co. 313 (Shahjahanpur), and M16, with thermal death points of 45°, 55°, and 65°, respectively. These differences were not ascribable to the variety, as the Co. 313 (Shahjahanpur) strain after passage through other varieties, including Co. 213 (Pusa) and M16, still had a T.D.P. of 55°. The mosaic strains also showed distinct differences in other physical properties, including dilution end point, longevity *in vitro*, and in permitting recovery from the disease. The virus was not filterable through Chamberland (L3) or Berkfeld (Y) filters. The strains readily cross-infected other varieties and were successfully transmitted to other hosts than sugar-cane, including sorghum, maize, and *Euchlaena mexicana*. P.O.J. 2878 was experimentally infected, and was found to be heavily diseased at Cuttack and Lyallpur. The same virus strain produced widely different patterns on different cane varieties. The virus was not transmissible through the true seed. Maize seed from plants artificially infected with virus from Co. 313 sugar-cane gave mosaic-free plants which remained healthy through three successive generations.

Co. 214 is the only Indian variety of sugar-cane that has not been successfully infected experimentally, neither has it been found naturally infected. Four years' trials showed that much variation in resistance occurs in different varieties; Co. 213, 223, 299, 312, 313, 331, 360, and 419 were highly susceptible.

While losses ascribed to sugar-cane mosaic in different countries range from 5 to

50 per cent. [cf. ibid., xviii, p. 500], careful experiments at Pusa with Co. 213 showed that even a 100 per cent. affected crop suffered only 10 to 12 per cent. reduction in yield of cane, with no loss in extraction or quality of juice. Similar results were obtained with Co. 213 at Patna and Cawnpore. With the thick *ponda* variety Surkha Saharanpuri there was 18 to 20 per cent. loss in cane yield, but no reduction in juice quality.

It may safely be concluded that in India mosaic does little damage to the Co. canes chiefly grown there, which seem highly tolerant. As, however, there are over 4,000,000 acres under sugar-cane in India, the loss from only 10 per cent. infection, involving 1 per cent. reduction in yield, would amount to Rs. 3,300.000 per annum.

Control can be achieved by planting seed from a mosaic-free area, or by careful roguing and selection of local setts.

CHOWDHURY (S.). **Some fungi from Assam. I.**—*Indian J. agric. Sci.*, xix, 3, pp. 230–233, 1944.

This list of fungi collected in Assam includes *Cystopus candidus* on Indian mustard, *Phytophthora colocasiae* on *Colocasia antiquorum*, *Taphrina deformans* on peach, *Tilletia* [*Neovossia*] *horrida* on rice, *Cercospora carthami* on safflower, *C. concors* on potato, and *C. personata* on groundnut.

GREENE (H. C.). **Notes on Wisconsin parasitic fungi. III.**—*Trans. Wis. Acad. Sci. Arts Lett.*, xxxv, pp. 113–135, 1943. [Received April, 1945.]

This continuation of the author's critical studies on the parasitic fungi of Wisconsin [*R.A.M.*, xxii, p. 409], based mainly on collections made during 1942, contains two new species and two new combinations.

WEST (E.). **Notes on Florida fungi. III.**—*Mycologia*, xxxvii, 1, pp. 65–79, 2 figs., 1945.

This third list of Florida fungi [*R.A.M.*, xx, p. 278] comprises 35 species, including *Gymnosporangium ellisii* on *Myrica cerifera*, *Sirosphaera chlorostoma* on the entomogenous fungi *Verticillium cinnamomeum*, ? *Aschersonia* sp., and *Aegerita webberi*, and *Sirosperma floridana* n.sp. on *Aschersonia* sp.

RHOADS (A. S.). **Further notes on the occurrence of Septobasidium spp. in Florida.**—*Plant Dis. Reptr*, xxix, 8, pp. 215–219, 1945. [Mimeographed.]

These notes provide additional information on the hosts and distribution in Florida of 16 species of *Septobasidium* collected between 1st January and 20th June, 1944.

BOSE (S. R.). **Importance of anatomy in systematics of Polyporaceae.**—*J. Indian bot. Soc.*, xxiii, 4, pp. 153–157, 6 figs., 1944.

The following anatomical characters, in addition to basidia and spore features, have been found helpful in the specific differentiation of Bengal Polyporaceae [*R.A.M.*, xxii, p. 454]: (1*a*) encrusted cystidia, (*b*) simple cystidia, (*c*) encrusted hyphae; (2*a*) setae in the hymenial layer, (*b*) no setae in the hymenial layer, (*c*) setae embedded in the trama, (*d*) presence of curved setae on the upper surface of the pileus; (3) a hyaline, cellular, interrupted layer on the upper surface; (4) resinous palisade-like tissue on the upper surface; (5) no palisade-like tissue on the upper surface, which is non-resinous; (6) indented or lacerated margins of the gills and pore mouths; (7) hyphal 'pegs' inside the pore-tubes which never bear basidia on them; (8) elongated, thick-walled conducting cells in the context and trama; and (9) thick-walled and dead fringe-hyphae covering the hymenium.

Mujica (F.). **El género Fusarium en Chile. Aporte preliminar a su conocimiento.** [The genus *Fusarium* in Chile. Preliminary contribution to its recognition.]—*Agric. téc. Chile* (formerly *Bol. Sanid. veg., Santiago*), iv, 2, pp. 224–229, 1 fig., 1944. [English summary.]

Following a brief survey of the literature relating to the genus *Fusarium* in Chile, a list is given of five species not hitherto recorded for the country and recently identified by O. Reinking and C. Carrera, namely, *F. culmorum* on vine and maize in the provinces of Santiago and Coquimbo, respectively; *F. semitectum* on a banana imported from Guayaquil, Ecuador; *F. solani* on lemons from the provinces of Nuble and O'Higgins; *F. rubi* on *Fragaria chiloënsis* from Llanquihue; and *F. sambucinum* on potato from Osorno.

Torrey (G. S.). **Two orthographic errors in fungous names.**—*Mycologia*, xxxvii, 1, pp. 160–162, 1945.

With reference to Dr. F. K. Sparrow's paper on *Myrophagus* Thaxter (*Mycologia*, xxxi, pp. 439–444, 1939), the author points out that he made drawings of this organism from specimens shown to him by Thaxter in 1915; the drawings are clearly labelled *Myiophagus*. Sparrow was shown the fungus by Thaxter in 1927, but it appears that Thaxter's specimens and drawings, now at the Farlow Herbarium, bear no name. *Myiophagus* means 'devourer of flies', and *Myrophagus*, apparently, 'ointment-eater.' There can, therefore, be no doubt as to which name was intended by Thaxter, and that used by Sparrow should be corrected to *Myiophagus*, in conformity with Article 70 of the Rules.

Limber (D. P.) & Cash (Edith K.). **Actinopelte dryina.**—*Mycologia*, xxxvii, 1, pp. 129–137, 1945.

Several collections of a fungus associated with leaf spots of oak (*Quercus* spp.), *Liquidambar styraciflua*, and *Eucalyptus* sp. were recently examined by the authors. The fungus appeared to be identical with *Leptothyrium dryinum* Sacc., 1878, renamed *Actinopelte dryina* by von Hoehnel in 1925 with *L. castanicolum* Ell. & Ev., 1888, *A. americana* Hoehn., 1925, restricted by von Hoehnel to American material, and (?) *Leptothyrella liquidambaris* Tehon & Stout, 1929, as synonyms. An emended description is given based on numerous herbarium and recent collections.

Beale (Helen P.) & Lojkin (Mary E.). **Quantitative studies on the precipitin reaction of the Tobacco-mosaic virus-antiserum system.**—*Contr. Boyce Thompson Inst.*, xiii, 8, pp. 385–410, 1 fig., 10 graphs, 1944.

This paper is stated to be the first of a series concerned with the quantitative precipitin reaction of various strains and derivatives of tobacco mosaic virus and their antibodies. After reviewing the development of the serum-precipitin from its use primarily as a qualitative test to an accurate quantitative method, the results of the authors' experiments with the type strain of tobacco mosaic virus are tabulated and discussed. The procedure adopted was based largely upon the methods of Heidelberger and Kendall.

Haslam (R. J.). **Harrow Resistant Broadleaf Burley.** *Lighter* (*Dep. Agric. Can.*), xv, 1, p. 14, 1945. [Mimeographed.]

A good selection of the Burley tobacco has been made at the Dominion Experimental Station, Harrow, Ontario, from Johnson's Broadleaf Resistant. The new strain, designated Harrow Resistant Broadleaf, is more resistant to black root rot [*Thielaviopsis basicola*: cf. *R.A.M.*, xviii, p. 824] than its parent, and is finding a ready market.

Prince (A. E.). **Initial infections of Tobacco blue mold on old and new beds in South Carolina.**—*Plant Dis. Reptr*, xxix, 10, pp. 270–271, 1945. [Mimeographed.]

From 19th to 23rd March, 1945, the author found the downy mildew fungus (*Peronospora tabacina*) present in 32 old beds in South Carolina and absent from 27. An examination of new beds showed the mildew to be present in five and absent in 77. It was noticed that heavily burned old bed sites had no downy mildew while unburned or lightly burned sites already showed it. Burning was, however, done to control weeds rather than the fungus.

Pizer (N. H.) & Downes (W. F.). **Iron deficiency in glass house Tomatoes.**—*J. Minist. Agric.*, lii, 3, pp. 120–126, 1945.

Severe iron deficiency occurred in tomatoes of the Stoner's Exhibition variety grown under glass near Ramsgate in 1944, the plants showing retarded or dwarfed growth, small terminal leaves yellow or white except along the veins, and pale red fruits (pale green or almost white when immature). The soil was overlying chalk and leaf analysis indicated excess lime in the plant probably tending to cause immobilization of iron. Twenty plants, showing slight to severe chlorosis, were top-dressed to a minimum depth of 1½ in. with 8 bush. moist peat containing ½ oz. iron sulphate per bush. Rooting took place nine days later and two waterings with iron sulphate solution (2 oz. to 2 gal.) were then given at intervals of a week. Three weeks after treatment began the plants were recovering. Early diagnosis and treatment is, however, essential, as plants which have suffered badly from chlorosis cannot be brought back into economic cropping.

Selman (I. W.). **Virus infection and water loss in Tomato foliage.**—*J. Pomol.*, xxi, 1–4, pp. 146–154, 1 fig., 4 graphs. 1945.

Studies in the transpiration of virus-infected tomato leaves during the incubation period [cf. *R.A.M.*, xx, p. 607] showed that when E.S. 1 tomatoes in pots were inoculated at the 12–13 leaf stage with tobacco-mosaic virus there was an increased rate of water loss, as compared with the controls, from the leaflets on the third day after inoculation. Similar results were obtained with Potentate tomatoes at the 6-leaf stage inoculated with tomato-spotted wilt virus.

From these and other experiments it is concluded that changes in the water relations may, perhaps, be one of the first reactions of living cells to virus proteins, and that the primary effect of the virus appears to be on cuticular transpiration in the tomato, and not upon stomatal behaviour. Inoculation of the upper leaf surface leads to increased transpiration from both upper and lower surfaces, older leaves tending to show a greater increase in the rate of water loss than younger leaves. It is suggested that transpiration methods could be used for the rapid detection of the presence of a virus.

Altstatt (G. E.) & Ivanoff (S. S.). **Yellow-top of Tomato.**—*Plant Dis. Reptr*, xxix, 1, pp. 29–30, 1945. [Mimeographed.]

The tomato abnormality referred to as 'yellow top', first reported in southwestern Texas in 1938, and again found in 1941, has occurred every autumn since, and in 1943, one field near Mercedes was 90 per cent. affected. In affected plants, the newest shoots and leaflets are completely without chlorophyll, and are bright yellow or nearly white. The affected shoots generally appear from the upper part of the plant, and are erect. Small, tan-brown, necrotic areas may appear in the chlorotic leaflets. Flower buds are yellow, and many abscise. Discoloured or necrotic areas with an occasional cavity often occur in young branches and stems. The older part of the plant appears to be normal and gives apparently normal fruits. Some old leaves may have bluish veins. Fruits on affected parts often show brown necrotic spots on the scar at the stem end. The flesh is hard, woody, and dis-

coloration is often present within the fruit. A single affected plant may be found between two normal ones in the same row. Apparently, the disease is of a virus nature.

Reichert (I.), Palti (J.), & Minz (G.). **Field trials for the control of Tomato leaf diseases.**—*Palest. J. Bot.*, R. Ser., iv, 2, pp. 117–141, 1944.

Tomato crops in Palestine suffer from five leaf diseases: powdery mildew (*Leveillula* (*Oidiopsis*) *taurica*) and *Alternaria solani* blight in all parts of the country and at all seasons: leaf mould (*Cladosporium fulvum*) in autumn-grown crops in the coastal plain and in winter and spring crops in the Jordan and Esdraelon Valleys, where the winter crops suffer from *Phytophthora infestans* blight; and leaf spot (*Septoria lycopersici*) [*R.A.M.*, xxiii, p. 319].

In spraying trials carried out from 1939 to 1941, lime-sulphur, cita lime-sulphur, and sulphinette (which increased yields by 53 per cent. in the Jordan Valley) at 1·5 per cent. (but not copper sprays) effectively controlled powdery mildew, and it is concluded that this disease can be controlled in the Jordan Valley by weekly sprayings with lime-sulphur. Leaf mould was controlled by the above-mentioned sulphur preparations and also by sulphocide (sodium pentasulphide) and shirlan AG at 1·5 per cent., Bordeaux mixture (1 per cent.), and perenox (0·33 or 0·5 per cent). The number of fruits injured by frost was markedly reduced by sulphinette, Bordeaux mixture, flordo, perenox (with or without oil), and cuprogreen concentrated (copper oxychloride), the number of injured fruits appearing to bear an inverse relation to the copper content of the spray.

Heinze (P. H.) & Andrus (C. F.). **Apparent localization of Fusarium wilt resistance in the Pan America Tomato.** *Amer. J. Bot.*, xxxii, 2, pp. 62–66, 4 figs., 1945.

To determine the nature of the resistance to wilt (*Fusarium oxysporum* f. *lycopersici*) [*F. bulbigenum* var. *lycopersici*] of the resistant Pan America tomato variety, approach and splice grafts were made with this variety, with the highly susceptible Bonny Best, and, in one test, with *Lycopersicon pimpinellifolium*, after which the plants were inoculated by Wellman's method by dipping the roots in the inoculum [*R.A.M.*, xix, p. 170; xxiii, p. 121] and planted on a greenhouse bench.

Three experiments were carried out, involving 142 approach grafts of Bonny Best and Pan America. About 40 per cent. of Pan America components showed some symptoms two or three weeks after inoculation. In most cases it was clear that the infection had crossed the graft union from Bonny Best to the Pan America.

Splice grafts were made involving Bonny Best scion on Pan America stock, Pan America scion on Bonny Best stock, Bonny Best scion on Bonny Best stock, and Pan America scion on Pan America stock, the plants being examined for infection 14 days after inoculation. Among the 121 Bonny Best scions on Pan America stocks slight external symptoms were discernible on four. Four other plants had some internal darkening of the vascular tissue, in each case below the graft union. The Pan America scions on Bonny Best stocks showed severe wilt in 118 out of a total of 120 plants. The other two plants showed internal symptoms above and below the graft union. All except one of the Bonny Best scions on Bonny Best stocks developed wilt. Four of the 97 Pan America scions on Pan America stocks showed some wilt. A few susceptible Pan America plants appeared in nearly all these experiments, but they generally represented under 5 per cent. of the total. The Pan America scions on Bonny Best stocks showed more severe symptoms than the Bonny Best scions on Bonny Best stocks. Darkening of the vascular tissue extended well up into the Pan America scion, and the causal organism was found in these scions.

A few Bonny Best scions were grafted on to *L. pimpinellifolium* stocks and the reciprocal grafts made. After inoculation and incubation, ten of the 11 Bonny Best

scions on *L. pimpinellifolium* were free of wilt and all of the 12 *L. pimpinellifolium* scions on Bonny Best showed pronounced wilt.

Splice grafts of Pan America scions on Bonny Best stocks, Bonny Best scions on Bonny Best stocks, and Bonny Best scions on Pan America stocks were made, and the plants inoculated through adventitious roots. Of the 29 Pan America scions on Bonny Best stocks, one showed slight internal symptoms, the remaining 28 being disease-free. Of the 32 Bonny Best scions on Bonny Best stocks, 23 showed definite external symptoms, seven presented internal symptoms, and two appeared to be unaffected. Of the 45 Bonny Best scions on Pan America stocks, 25 showed external symptoms, 12 internal symptoms, and eight appeared to be unaffected.

Cultures made of sterile whole tissues and sterile unheated extracts from the tissues of resistant and susceptible plants failed to show the presence of any substance in the resistant plants toxic to the fungus.

The most important observation made in this work is the complete susceptibility of the Pan America scions when supported on a susceptible Bonny Best root system. Resistance to the wilt fungus in tomatoes appears to be localized completely in the root system of the resistant varieties; apparently, it is not transportable.

Cojocaru (C.). **Comportarea câtorva soiuri de Pătlăgele Roșii față de putregaiul inelar al fructelor.** [Reaction of some Tomato varieties to fruit ring rot.]—*Viața agric.*, xxxv, 9–10, pp. 159–160, 1944.

Ring rot of tomato fruits (*Phytobacter lycopersicum*) [*Bacterium lycopersicum*: *R.A.M.*, xiii, pp. 194, 288; xvi, p. 302] was prevalent in 1943 at the Agricultural Experiment Station, Cenad, Rumania, where comparative studies on varietal characteristics were in progress. Of the 13 varieties under observation, Imun and Lucullus were the most resistant, with reductions of 0·83 and 1·73 per cent., respectively, of the total product and 1 per cent. in both cases reckoning the fruits separately. The losses in fruit of the varieties Varșovia, Alice Roosevelt, Olandeze, Plovdiv, Ambassador, Budapest, Maginot, Trofei, Triumph, Aurora de Comet, and Ciudorinca amounted to 20, 27, 10, 38, 7, 25, 10, 22, 18, 7 and 23 per cent., respectively.

Tyler (L. J.) & Parker (K. G.). **Pathogenicity of the Dutch Elm disease fungus.**—*Phytopathology*, xxxv, 4, pp. 257–261, 1945.

Eight culturally distinct races of *Ceratostomella ulmi*, originating as sector variants in mass isolates obtained in 1934 from diseased American elms (*Ulmus americana*) in New York, were inoculated in 1942 into five-year-old trees of the same species, of which 11 were utilized for each of the races A2, A3, A4, B, C, D, and E, while A1 and a mixture of several were applied to 22. Four of the races proved to be actively pathogenic, viz., A1, A2, B, and D, which killed 18 out of 22, 5 out of 11, 6 out of 11, and 9 out of 11 trees, respectively, with corresponding percentages of dead wood of 93, 86·2, 83, and 89·2, respectively. A3, A4, and C caused less severe injury, killing none of the trees and being associated with only 43·6, 22·8, and 34·2 per cent., respectively, of dead wood. The non-sporulating race E was completely non-pathogenic, but the composite inoculum was equally virulent with the four actively deleterious races, killing 14 out of 22 trees and being responsible for 91·2 per cent. of dead wood. The pathogenicity of the several isolates was not appreciably modified by seven years' culture on potato dextrose agar without passage through the elm.

Alben (A. O.) & Hammar (H. E.). **The effect on Pecan rosette from applications of zinc sulfate, manure, and sulphur on heavy-textured alkaline soils.**—*Proc. Amer. Soc. hort. Sci.*, xlv, pp. 27–32, 1944.

In further work on the control of pecan rosette [*R.A.M.*, xxii, p. 281], an experi-

ment was carried out in the spring of 1941 on Pledger clay soil in Texas, in which the following treatments were applied: manure, sulphur, and zinc sulphate; sulphur and zinc sulphate; manure and sulphur; zinc sulphate; and sulphur. Zinc sulphate was used at 50 and 75 lb. per tree. One cu. yd. sheep manure and 50 lb. sulphur were composted for each of the ten trees used.

The results obtained showed that all the trees that received the zinc sulphate, manure, and sulphur combination had completely recovered by June, 1943. The sulphur and zinc sulphate treatment came next in effectiveness, followed closely by zinc sulphate alone. Sulphur by itself reduced, but did not cure, the condition. The sulphur and manure treatment was no better than the control.

A second experiment was carried out on Catalpa clay soil in 1942 on trees severely rosetted since 1934. For each tree, $\frac{1}{5}$ cu. yd. dairy manure was composted with 50 lb. sulphur, and zinc sulphate at the rates of 50, 85, 100, and 200 lb. per tree was mixed with the compost. To half the trees, the manure, sulphur, and zinc sulphate mixture was applied broadcast and ploughed under, and to the remainder it was applied in holes, 8 in. in diameter, made in the soil at 2-ft. intervals in a circle round the tree 8 ft. from the trunk. After 16 months all the trees given 100 or 200 lb. zinc sulphate with manure and sulphur had recovered except one. Of those given under 100 lb. zinc sulphate, all showed marked improvement. In general, the broadcast application appeared to be rather more effective than the application made in holes.

The Pledger clay had a zinc-fixing power of the 0 to 6 in. horizon of 4,800 lb. zinc per acre, while the corresponding amount for the Catalpa clay was 60,000 lb. It is considered that rosetted pecan trees on almost any soil should respond satisfactorily to the treatment.

Drosdoff (M.) & Kenworthy (A. L.). **Magnesium deficiency of Tung trees.** —*Proc. Amer. Soc. hort. Sci.*, xliv, pp. 1–7, 1 fig., 1944.

Tung [*Aleurites fordii*] trees in Florida suffer from a severe marginal leaf scorch associated with magnesium deficiency and characterized by yellow blotches, rapidly developing into brown, necrotic areas, sometimes involving most of the surface, inward curling of the edges, premature defoliation, and eventual stunting. Some alleviation of the symptoms was procured by the incorporation into the soil of nitrogen as a mixture of 1 lb. each of sodium nitrate and ammonium sulphate per tree, and gypsum may also have contributed to an improvement in the health of the trees, but complete recovery was ensured only by soil applications of magnesium sulphate made annually for two years at dosages of 8 and 4 lb. per tree, respectively, for 10- to 12- and 6- to 8-year-old trees. The magnesium content of the foliage from treated trees ranged from 0·20 to 0·35 per cent. compared with 0·05 to 0·16 per cent. in the severely scorched controls.

Smith (M. E.). **Micronutrients essential for the growth of Pinus radiata.**— *Aust. Forestry*, vii, pp. 22–27, 1943.

At the University of Western Australia, *Pinus radiata* seedlings were grown in Hoagland's culture solution [*R.A.M.*, xiv, p. 376] in two series, one of which was supplied with zinc (0·1 or 0·5 mg. per l.), manganese (0·1 mg.), copper (0·02 mg.), molybdenum (0·01 mg.), and boron (0·1 or 0·5 mg.) [ibid., xx, p. 40], while the same elements were withheld from the other. The symptoms induced by deficiencies of these elements are described in detail.

Rhoads (A. S.). **Witches' broom of Pine trees in Florida.**— *Plant Dis. Reptr*, xxix, 1, pp. 26–28, 1945. [Mimeographed.]

Witches' brooms, of a striking type, and the origin of which has not yet been determined, have been observed recently in Florida on pond pine (*Pinus rigida*

var. *serotina*), sand pine (*P. clausa*), and slash pine (*P. caribaea*). On pond pine the brooms generally occur on the lower or median portion of the crown. In one case, a compact, rounded broom occupying the lower median portion of the crown, was at least 10 ft. in diameter. In such examples the large, compact, rounded mass of limbs composing the broom contrasted markedly with the thin foliage of the tops of the trees. Less conspicuous brooms occurred on other pond pines, radially disposed round the trunk, but occasionally present on the end of a limb. On one pond pine, a great broom with 16 ft. lateral spread started on one side of the trunk at a point $8\frac{1}{2}$ ft. above the ground, and consisted chiefly of long, radiating branches, densely feathered with foliage and showing a dense terminal growth.

On sand pines the brooms were confined mainly to individual branches: only a single branch appeared to be involved, usually high up in the crown. The brooms developed into rounded, compact, densely branched structures generally spherical in outline, but sometimes flattened. They ranged up to 3 ft. in diameter. The limbs showed an abnormally dense growth of branches, with foliage and cones shorter than those on the normal limbs. Giant brooms were found on two fairly young sand pines, and one with a spread of 20 ft. was noted on a slash pine.

The conclusion that the giant brooms, at least, develop at the expense of the balance of the tree is supported by the work of Tubeuf [*R.A.M.*, xii, p. 663.]

Hartley (C.) & May (C.). **Decay of wood in boats.**—12 pp., 1 fig., U.S. Dep. Agric., 1943. [Mimeographed. Received June, 1945.]

This preliminary report on decay of wood in boats is based on surveys made in 1942 by members of the American Division of Forest Pathology of the Bureau of Plant Industry at construction and repair yards. The chief factors responsible appear to be poor material, warm climate, fresh water, leaks, and dead air spaces. Fungi that commonly attack boat timbers include *Poria xantha* on hard and softwoods, *Daedalea quercina* and *Stereum frustulosum* [*S. frustulatum*] on oak, and *Lenzites sepiaria* on softwoods. To reduce decay as much as possible, heartwood of durable species should be used at all critical points of the construction. Wood employed in ship-building should be reasonably seasoned and free from fungal infection before assembly. Water, particularly fresh water, should be kept out and all parts of the hull should be ventilated. If it is necessary to use sapwood and install a tight ceiling, the critical parts of the hull should be constructed of species of wood that take preservative treatment readily. The wood used should be impregnated with a suitable preservative. Where good materials and ventilation are provided, impregnation is not necessary in emergency building, but more superficial treatments should prove useful; in special cases, salt packing may be worth while.

Hansbrough (J. R.), Waterman (Alma M.), & Luxford (R. F.). **The significance of the discolorations in aircraft veneers: Yellow Birch.**—*Mimeo U.S. Dep. Agric.* 1377, 7 pp., 6 figs., 1943. [Received June, 1945.]

Yellow birch (*Betula lutea*) is one of the most important hardwoods used in modern plywood planes, but of the total volume of aircraft-grade yellow birch logs only about 30 to 40 per cent. can be made into veneer of aircraft quality. Of the rejections, 10 per cent. are due to 'dote' [*R.A.M.*, xxii, p. 415] or to discolorations mistaken for it.

The examination of material from 27 mills showed that the forms of discoloration that indicate little or no reduction in toughness comprise light streaks in the heartwood, blue-black metal stains and soot or cinder flecks, yellow to orange chemical stain in the sapwood, pith flecks, and blue stain [loc. cit.] in the sapwood. Discolorations indicating slight to moderate reduction in toughness comprise mineral streaks [loc. cit.] in both sapwood and heartwood, heartwood streaks in the

sapwood, and striped or banded zones in the heartwood. Discolorations indicating excessive reduction in toughness, and rendering yellow birch unacceptable according to official standards in the United States, comprise those forms of decay observed in the present work only in heartwood veneer, and invariably white, cream, yellow, or brown, which produce rough, fibrous, or velvety veneer. Such wood breaks brashly across the grain with little or no splintering, and cracks or splits readily parallel to the grain. In drying, it shrinks and warps, and in advanced stages is perceptibly light and soft. Small, open pockets, zone lines, mottled spots, or black flecks are often associated with decay, but in many cases the wood turns into a uniformly coloured spongy or fibrous mass. The rarely observed brown rot [unspecified] is at first lightly pitted or pocketed and later becomes stringy.

Blue stain occurs infrequently and is limited to the sapwood. It forms light blue streaks running 1 or 2 ft. from the end of logs stored too long during warm weather or shorter stretches centred at worm-holes. When blue stain is present careful inspection for decay is even more necessary.

As a rule, discolorations due to decay produce patterns much less definite in shape and delimitation than do non-injurious discolorations. The former merge gradually into the surrounding clear wood and seldom follow growth-ring patterns. They sometimes resemble mineral streaks but may readily be distinguished from them by the brashness and softness of the wood.

Hartley (C.) & Scheffer (T. C.). **Recommended practice for controlling sap stain in aircraft Yellow Poplar lumber.**—*Mimeo U.S. Dep. Agric.* 1378, 3 pp., 1 fig., 1943. [Received June, 1945.]

Recommendations are made for the control of sap stain (blue stain) [*R.A.M.*, xxii, p. 415] in yellow poplar [*Liriodendron tulipifera*] lumber used in aeroplane manufacture. To avoid infection the logs should be promptly brought in from the woods and sawn within a few days, if the weather is warm. If prompt sawing is impossible, the logs can be protected for some weeks by treating the ends and barked places within 24 hours of 'bucking' with dowicide H (30 lb. per 100 gals. water), lignasan (8 lb. per 100 gals.), or permatox 10 S (40 lb. per 100 gals.), applied with a garden-sprayer or a brush. When the stain is hard to control, the amount of chemical used may be increased by one-sixth to one-third. The quantities necessary should cost only 5 or 6 cents per 1,000 ft.

To prevent stain in lumber, it should be put into the kiln within 72 hours of leaving the saw. If kiln-drying has to be delayed, the lumber should be dipped within 24 hours of coming from the saw in dowicide H (6 lb. per 100 gals.), permatox 10 S (10 lb.), or lignasan (2 lb., or 1 lb. if 16 to 20 lb. borax are added). Larger amounts may sometimes be necessary. Powdered borax (preferably dissolved in warm water) can be used alone with poplar lumber, a rate of 32 lb. per 100 gals. being recommended. Promptly-dipped lumber can be bulk-piled for two weeks or more while awaiting drying. If the lumber is to be air-seasoned, it should be dipped within 24 hours of sawing, and piled in the open in well-ventilated conditions under a protective roof. If neither kiln-drying nor dipping is possible, the best possible air-seasoning practice should be followed.

The paper concludes with useful notes on dipping technique and on precautions to be observed when using stain-preventive chemicals. The cost of the chemicals required for dipping is about 15 cents per 1,000 board ft. of 4/4 lumber dipped.

Tentative standard instructions for the inspection of preservative treatment of wood.—*Proc. Amer. Wood Pres. Ass.*, xl, pp. 145–153, 1944.

Detailed instructions are given for the inspection of all treatments of forest products under the American Wood Preservers' Association standard specifications.

Tentative standard specification for the preservative treatment of Oak.—*Proc. Amer. Wood Pres. Ass.*, xl, pp. 69–76, 1944.

Tentative specifications which have been laid down for preserving oak sleepers and lumber by pressure processes cover equipment, conditioning, sorting and spacing, machining, oil treatment, manner of treatment by the Lowry, Rueping, Bethell, and Burnett processes, and retention of preservative.

Schmitz (H.), von Schrenk (H.), & Kammerer (A. L.). **II. Decay resistance of Red Oak cross-ties, treated with coal-tar creosote after 34 years' service.**—*Proc. Amer. Wood Pres. Ass.*, xl, pp. 76–106, 5 figs., 1944.

This is the second of a series of studies of the biological environment in treated wood in relation to service life [*R.A.M.*, xxi, p. 108]. It describes an attempt to establish by laboratory tests, under optimum or sub-optimum growing conditions, the relative resistance to *Lenzites trabea* and *Daedalea quercina* of untreated red oak [*Quercus* spp.] and similar sleepers originally treated with coal tar creosote, found free from decay after 34 years' service, and removed from the track only because of mechanical destruction. Examination of test blocks taken from untreated sleepers after twelve months' exposure in a jar on a nutrient malt agar culture inoculated with *L. trabea* and *D. quercina* showed a maximum loss of 55·5 per cent. and an average loss of 37·6.

In the case of the treated sleepers, the authors' conclusions are as follows. Although there were no signs of these sleepers having reached the end of their decay-resistant life when they were withdrawn from service, small test blocks cut from their exterior parts were attacked by the test fungi under laboratory conditions, which are more favourable to the fungi than those on the track. Moreover, in the sleeper as a whole the decay resistance in any part is influenced by the preservative conditions in adjacent parts. Thus, even in a treated sleeper which has withstood the ravages of wood-destroying fungi for 34 years, there are wood areas which, when isolated or changed in position with relation to other areas in the sleeper, may be subject to attack by wood-destroying fungi under certain conditions. Wood in the interior of a treated sleeper may be preserved from attack by fungi even though that same wood—when exposed as a cut—may be susceptible to decay. Treated sleepers should be treated as ecological units when considered as a potential habitat for wood-destroying fungi. When such sleepers are cut in any way the total factors inducing resistance to decay in the original sleeper are altered completely, nor is it possible to reconstruct the total decay resistance of sleepers by piecing together any number of larger or smaller units cut from them.

Rennerfelt (E.). **Blånad och blåytesvampar.** [Blueing and blue-stain fungi.]—*Skogägaren*, xx, 4, pp. 84–88, 91, 4 figs., 1944.

Much of the information contained in this summary of the present position in Sweden regarding the fungal agents of blue stain of wood pulp [including *Phialophora fastigiata*, *Phoma lignicola*, *Pullularia pullulans*, *Trichosporium heteromorphum*, and, under certain conditions, *Ceratostomella piceae*] has already been noticed from other sources [*R.A.M.*, xxi, p. 57 *et passim*], but the following observations may be of interest. Butovitsch and collaborators [no bibliographical reference cited] conducted an experiment in 1938 aiming at the control of the pathogens by storing the pulp in a saturated condition: if not actually submerged in water, the bales should be covered with moss, sod, lichen, cardboard, or some other permeable material. This operation is greatly complicated if performed shortly before the swarming period of the bark beetles [*Scolytus* spp.] concerned in the transmission of the blueing fungi. In this connexion it has been noticed that the discoloration assumed a more severe form when conveyed to the wood by the beetles than in the case of direct infection by wind-borne spores, which do not immediately penetrate

the corticated parts. The application to the wood of an arsenical preparation, effective against the bark beetles, is attended by a serious disadvantage, namely, its stimulatory action on the blueing fungi. The latter are amenable to control by mercury-containing compounds, e.g., fibrosan, lignasan, and pulpasan, which should therefore be used on the end surfaces and other bark-free areas, reserving the arsenicals for the corticated portions.

Snyder (W. C.) & Baker (K. F.). **Diseases of seed Cauliflower in California.**—*Plant Dis. Reptr*, xxix, 10, pp. 248–252, 1945. [Mimeographed.]

The authors point out that most of the cauliflower seed used in the United States is supplied by California. Disease surveys made during 1942–44 showed that downy mildew (*Peronospora parasitica*), white blight (*Sclerotinia sclerotiorum*), and mosaic [cauliflower mosaic virus] are the more important diseases present, but do not yet threaten the production or quality of the seed. Powdery mildew (*Erysiphe polygoni*), white rust (*Albugo candida*) [*Cystopus candidus*], *Alternaria* leaf spot (*A. brassicae* and *A.* spp.), ring spot (*Mycosphaerella brassicicola*), and *Phytophthora* root rot (*P. megasperma*) were present in slight or trace amounts, whilst the diseases not found included black rot (*Xanthomonas campestris*), blackleg (*Phoma lingam*), yellows (*Fusarium oxysporum* f. *conglutinans*), club root (*Plasmodiophora brassicae*), and bacterial spot (*Pseudomonas maculicola*). Black rot and black spot not being present, hot-water treatment of the seed is not required, and California meets the demand for seed free from these diseases. Observation shows that California cabbage, broccoli, kohlrabi, and Brussels sprouts seed are also free from them.

Hull (R.) & Watson (Marion A.). **Virus yellows of Sugar Beet.**—*J. Minist. Agric.*, lii, 2, pp. 66–70, 3 figs., 1945.

In this account of virus yellows of sugar beet and its control [*R.A.M.*, xxiv, p. 260] the authors state that the main factor affecting loss of yield is earliness of infection. A crop with 100 per cent. infection in July loses about 50 per cent. of its potential yield of sugar. If infection occurs later, the losses are correspondingly less; thus, 100 per cent. infection in mid-September reduces the yield by only 15 to 20 per cent.

Snyder (W. C.) & Middleton (J. T.). **Lima Bean diseases in California.**—*Plant Dis. Reptr*, xxix, 8, p. 206–208, 1945. [Mimeographed.]

The authors give the results of a survey undertaken in 1944 of the diseases of the Lima bean (*Phaseolus lunatus*). The importance of this rather specialized crop is that California supplies the mid-western and eastern States with high-quality Lima bean seed and that western-grown Lima bean seed is reported to carry bacterial blight [*Xanthomonas phaseoli* and other organisms]. The large crop grown for dry beans and seed during normal dry summer seasons was the object of this survey, particularly in the southern coastal counties, where culture of the common Lima for dry beans is rather restricted. The results conform to those obtained in recent years. Foliage and pod diseases were conspicuously absent. Occasional heat blast of the top set of pods, some *Rhizoctonia* infection (*R.* [*Corticium*] *solani*), physiological reddening or burning of foliage, and a trace of powdery mildew [*Erysiphe polygoni*] were the only foliage or pod diseases observed. Soil troubles were more numerous but unimportant. Experience shows that *C. solani*, *Fusarium solani* f. *phaseoli*, and *Pythium ultimum* may cause seedling damage, while later in the season *Macrophomina phaseoli*, nematodes, and insects can give minor trouble. The authors conclude that Californian Lima bean normal summer-grown seeds carry no bacterial pathogens, for no bacterial infection of the plants has anywhere been observed.

McNew (G. L.). **Bean anthracnose may be checked by new spray.**—*Fm Res.*, x, 2, p. 19, 1944.

During the past 20 years, bean anthracnose (*Colletotrichum lindemuthianum*) [*R.A.M.*, xxii, p. 50; xxiii, p. 329] has been relatively unimportant in New York, owing to the practice of crop rotation and the use of disease-free seed. In the last two seasons, however, severe local losses have occurred in some important bean-growing areas, such as Madison County.

A test was carried out in which heavily infected seed was planted in rows interspersed between rows of clean seed of the same variety. A plot of eight rows 200 ft. long was divided into four blocks. Two were left unsprayed, and two were treated with fermate (2 lb. per 100 gals.) at intervals of 10 to 14 days, beginning when the first true leaves were fully expanded. Anthracnose appeared about 15th August and spread uniformly throughout the unsprayed plots, though only rare, isolated spots of infection appeared on the sprayed plots. The evidence showed conclusively that the spraying effectively reduced infection and saved about 30 per cent. of the pods. The effect of the fermate on spread was shown by an examination of the plants grown from clean seed. On 14th September, these showed 34·7 and 36 per cent. severe pod infection in the two unsprayed blocks and 0 and 3·2 per cent. in the sprayed.

Smith (H. P.), Altstatt (G. E.), & Byrom (M. H.). **Harvesting and curing of Garlic to prevent decay.**—*Bull. Tex. agric. Exp. Sta.* 651, 28 pp., 10 figs., 1944.

Studies carried out in Texas from 1936 to 1943 on the prevention and control of decay of garlic bulbs [*R.A.M.*, xxii, p. 462] at harvest and in transit showed that the organisms most commonly obtained in culture from decaying garlic included species of *Aspergillus*, *Diplodia*, *Fusarium*, *Helminthosporium*, *Penicillium*, and *Trichoderma*, together with *Sclerotium bataticola* [*Macrophomina phaseoli*] and *S. rolfsii*. Among the bacteria present, the only organism identified was *Bacillus carotovorus* [*Erwinia carotovora*].

Small response in yield resulted on black-land soil near Moulton with 4–12–4, 6–12–6, or 6–18–6 fertilizers applied at 300 to 900 lb. per acre. When sulphur and cuprocide were applied separately in the furrows at 400 and 800, and 200 and 400 lb. per acre, respectively, before dropping in the seed, delayed germination, poorer stands, and lower yields resulted. Pre-planting treatment of garlic clones for seed with nine different chemical disinfectants appeared in most cases to retard and reduce stands, and failed to increase yields. During $3\frac{1}{2}$ months' storage, decay was less when the garlic was cured for 10 to 14 days on wire racks in an open shed or in a barn loft, than when it was cured on the floor of a barn, left in the field, or cured by artificial heat. Drying with hot air (average 120° F.) took 20 to 30 hours, and temperatures over 125° injured the bulbs and increased decay. Bulbs treated with chemical disinfectants and then stored kept no better than the controls.

To secure the largest yields of good-quality garlic, sound, disease-free seed pieces should be planted on low ridges in October and early November, harvested when most of the tops have turned brown, and then cured under shelter on open racks for 10 to 14 days.

Schreiber (F.). **Erfahrungen über Salatzüchtung.** [Observations on Lettuce-breeding.]—*Kühn-Arch.*, lx, pp. 462–465, 1944.

One of the objects of lettuce-breeding for the German market is the development of resistance to downy mildew (*Bremia lactucae*), collar rot (*Sclerotinia sclerotiorum*), and grey mould (*Botrytis cinerea*), and with this end in view crosses have been made of wild forms. Interesting possibilities have already emerged among the fully fertile progeny of *Lactuca sativa* × *L. scariola*, which there is reason to believe represent one and the same species. Segregation in the F_2 resulted in a great variety of forms,

predominantly of the rosette type. Similar experiments are in hand with the wild species *L. saligna*, *L. viminea*, *L. virosa*, and *L. perennis*.

Selman (I. W.). **The susceptibility of Lettuce to mosaic virus in relation to nitrogen, phosphate, and water supply.**—*J. Pomol.*, xxi, 1–4, pp. 28–33, 1 pl., 5 graphs, 1945.

When Cheshunt Early Giant lettuces growing under glass in autumn in a mixture of peat and sand with all combinations of three levels of nitrogen, three of phosphate, and two of watering (medium and high) were mechanically inoculated with lettuce mosaic virus [*R.A.M.*, xviii, p. 649], the most susceptible to infection (100 per cent. mosaic) were those given high nitrogen, medium phosphate, and both medium and high water, and the least (12½ per cent. infection) those given low nitrogen, low phosphate, and medium water. A significant nitrogen-water interaction for susceptibility suggested that the available nitrogen content of the soil may be an important factor in determining susceptibility. The mean weights of 87 immature infected lettuces and 144 healthy ones (all treatments) were, respectively, 13·6 and 43·4 gm., a reduction in fresh weight due to infection of 68·7 per cent.

Brooks (F. T.). **A Pythium rot of Cucumbers.**—*Trans. Brit. mycol. Soc.*, xxvii, 3–4, pp. 134–136, 1945.

Both young and mature fruits of Telegraph cucumber growing in a heated glasshouse with their stems trailing in soil decayed, and when the fruits were placed in a saturated atmosphere they became covered with a profuse white, non-septate mycelium to a depth of 1·5 cm. The odour was somewhat pleasant, not suggesting bacterial decay. The symptoms agreed closely with those described by Drechsler [*R.A.M.*, v, p. 71] for the rot of cucumbers caused by *Pythium aphanidermatum*. Pure cultures were easily obtained and were compared with those of *P. ultimum* from a wilted *Delphinium* and *P. aphanidermatum* supplied by C. J. Hickman [ibid., xxiii, p. 359]. Inoculations of cucumbers through shallow wounds in the surfaces of washed and sterilized mature fruits were performed simultaneously with the three fungi. No differences were observable with regard to the aerial mycelium or the rate of rotting, but on the mycelium of *P. aphanidermatum* there appeared abundant sexual organs and oospores; on *P. ultimum* conidia were formed as well, but the cucumber isolate only showed conidia. Abundant conidia were formed by the last-named on a variety of media, but as with *P. ultimum*, they never gave rise to zoospores. Pathogenicity is identical with that of *P. ultimum*, causing a similar soft rot on potato and carrot tissues. The cucumber fungus is probably a strain of *P. ultimum* which has lost the capacity to produce sexual organs. This belief is strengthened by the investigations of Tompkins *et al.* [ibid., xviii, p. 497], showing that some isolates of a soft rot of pumpkin and watermelon are asexual.

Miller (J. J.). **Studies on the Fusarium of Muskmelon wilt. I. Pathogenic and cultural studies with particular reference to the cause and nature of variation in the causal organism.**—*Canad. J. Res.*, Sect. C, xxiii, 1, pp. 16–43, 2 pl., 2 figs., 1 graph, 1945.

A serious disease of muskmelons, first reported in Ontario about 1937, causes a wilting of the vines or, when less severe, general unthriftiness and fruit failure, as well as, in strongly infested soil, damping-off and seed decay. From the diseased plants a *Fusarium* has been isolated closely similar to *F. bulbigenum* var. *niveum* f. 2 reported by J. G. Leach and T. M. Currence (*Tech. Bull. Minn. agric. Exp. Sta.* 129, 1938) as causing a wilt of muskmelons in Minnesota. The Minnesota fungus has, however, larger spores but it is thought that these measurements might have been taken from mutants. Isolations from diseased plants in naturally infested soil indicated that the fungus occurs in nature as a form (or forms) producing in culture

abundant aerial mycelium and this is termed the 'wild type'. From this, mutants with less aerial mycelium and darker submerged mycelium are readily produced on all media, and frequently tend to replace the less aggressive parent. The wild type appears to be genetically very stable in its habitat, whereas the mutants tend to disappear in soil infected with both 'wild' and mutant strains. Furthermore, certain of the commoner mutants caused less disease in the field than the 'wild type' and it is considered that variation of the sort observed in culture, if it does occur in the field, is unlikely to be important in the pathology of the disease. The stability of the 'wild type' in sterilized soil and soil agar points to these substrata being of value in maintaining species of *Fusarium* in the pure state. Mutations can be induced by ultra-violet light, though not by heat, and these resemble the natural mutations in appearance and behaviour. The term 'cultural interaction' has been applied to the phenomenon of the invasion of one form by its mutant. It can be clearly seen when the mycelium of the dark mutant invades that of the lighter 'wild type'. It is to some extent specific and may be of taxonomic value. The suggestion is offered that the concept of a 'wild type' may be of wide application in the genus.

MUNGER (H. M.). **Iroquois Muskmelon is resistant to Fusarium wilt.**—*Fm Res.*, x, 2, p. 20, 1 fig., 1944.

The Iroquois muskmelon has been developed to meet the requirements of growers in New York State who have been troubled by *Fusarium* wilt [*F. bulbigenum* var. *niveum* f. 2: *R.A.M.*, xxi, p. 438; xxiv, p. 351]. Iroquois is a selection from a cross between Minnesota Selection 99–36 and Bender. In comparative tests commercial varieties planted as controls never matured a single marketable fruit, whereas Iroquois showed no infection in two years.

WATSON (R. D.). **Sweet Potato soil rot slip treatment and varietal reaction tests in Texas.**—*Plant Dis. Reptr*, xxix, 9, pp. 240–241, 1945. [Mimeographed.]

In a test carried out in Texas on the control of sweet potato soil rot (*Actinomyces ipomoeae*) [*R.A.M.*, xxii, p. 160] by means of chemical treatments, using the Porto Rico variety, the yields obtained were as follows: untreated slips (in each case) 100, semesan bel 115, sulphur dust 93, and fermate dust 108. The percentages of diseased roots were: untreated slips 29·3, semesan bel 35, sulphur 29·2, and fermate 28·8.

Varietal resistance tests showed that B-16 and B-4018 had no infection, L-12, an attractive, yellow-fleshed variety, 3 per cent., Red Velvet 9·5 per cent., and Porto Rico 14·6 per cent. In the case of First Born of Russia and Mameyita, infection reached 28·3 and 31·4 per cent., respectively.

Native Authority Ordinance 1943 (No. 17 of 1943).—The Ibadan Native Authority (Control of Swollen Shoot) Order 1945.—1 p., 1945.

This Order [*R.A.M.*, xxi, p. 544], applicable to the Ibadan Division of Oyo Province, Nigeria, empowers Native Authority or its representative to inspect any cacao farm, and destroy by stumping all cacao trees deemed by the Director of Agriculture or his representatives to be infected with swollen-shoot disease.

Restrictions on the importation of Tomato seed.—*Fmg S. Afr.*, xx, 229, p. 206, 1945.

Owing to the danger of introducing *Aplanobacter* [*Corynebacterium*] *michiganense* [*R.A.M.*, xxiii, p. 80] into South Africa, which is believed to be as yet free from the disease, the importation of tomato seed is prohibited as from 1st September, 1945, except for varieties whose importation is considered desirable by the Division of Horticulture. These will be grown in quarantine under official supervision.